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14. ABSTRACT
The general objective of the Ohio Army National Guard Mental Health Initiative is to evaluate the relationships between resilience and risk factors, both cross-sectionally and longitudinally, before, during, and after deployment in the Ohio Army National Guard. The primary project collects long-term data on a random representative sample of up to 3,000 service members per year in the OANG, both treatment seeking and non-treatment seeking. Over the past year, three manuscripts have been published, with 6 others currently under peer review. An additional six data analyses are completed with manuscripts in preparation and 12 analyses are in process. The investigators have continued to focus on alcohol use disorders and suicide as areas of unmet need in the National Guard. For example, 10% of our study sample qualified for wave 1 depression, and 9% of those soldiers had suicidal ideation at the 1-year follow-up, as compared to only 2% among those with no depression at baseline (p<0.0001). Additionally, among those reporting wave 1 alcohol dependence (6% of N=1587 without depression or prior suicidal ideation), 9% reported suicidal ideation at 1-year follow-up, compared to only 2% incident suicidal ideation among those with no baseline alcohol dependence (p=0.0002). These results highlight the need for further study, prevention, and intervention of alcohol use disorders in the military.

15. SUBJECT TERMS
Risk, Resilience, Combat, Posttraumatic Stress Disorder, Ohio National Guard, Mental Health, Genetics, Alcohol Use Disorders, Suicide

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Ohio Army National Guard Mental Health Initiative: Risk and Resilience Factors for Combat-Related Posttraumatic Psychopathology and Post Combat Adjustment

Final Report, May 2012

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Final Report

Ohio Army National Guard Mental Health Initiative: Risk and Resilience Factors for Combat-Related Posttraumatic Psychopathology and Post Combat Adjustment

INTRODUCTION

The general objective of the Ohio Army National Guard Mental Health Initiative was to create a research infrastructure capable of supporting a series of projects that evaluate the relationships between resilience and risk factors, both cross-sectionally and longitudinally, before, during, and after deployment. The primary project collected long-term data on a random representative sample of service members in the Ohio Army National Guard, both treatment seeking and non-treatment seeking. The Telephone Survey was completed on all main project participants on an annual basis, and a subsample of these participants also had an in-depth In-Person Survey on an annual basis for the duration of the study. The Genetics Repository component collected a DNA saliva sample from consenting participants in the main project.

BODY

The Initiative was designed to study the relationships between 1) pre-existing mental illness/substance use disorders, 2) deployment to Operation Iraqi Freedom (OIF) or Operation Enduring Freedom (OEF), and 3) post-deployment related mental health and overall psychosocial adjustment and functioning. The study evaluated several groups of the Ohio Army National Guard: those deployed to OIF (Iraq, Kuwait, or Qatar), those deployed to OEF (Afghanistan), those deployed to other theaters (Bosnia, Turkey, Uzbekistan, Kosovo, on a ship, or other), those deployed domestically, and those not deployed.

Project #1 (main cohort – Telephone Survey and In-Person Survey) and Project #2 (Genetics component) are ongoing (W81XWH-10-1-0579). An ancillary project entitled: "Neuroimaging and Genetic Investigation of Resilience and Vulnerability to PTSD" began enrollment in February 2012. Future ancillary projects are dependent upon outside funding being awarded, and may include an alcohol intervention/prevention study.

Sites
The team of individuals and infrastructures committed to this project is extensive and has a reporting relationship to the leadership of the Ohio National Guard, The Ohio Adjutant General Deborah Ashenhurst and Assistant Adjutant General of the Army Brigadier General John Harris, through the Guard's OHIOCARES Workgroup. The Principal Investigator (PI) of the Ohio Army National Guard Mental Heath Initiative is Joseph R. Calabrese, M.D. and the Co-PI is Marijo

Tamburrino, M.D. The Initiative includes a Coordinating Center based out of University Hospitals Case Medical Center (UHCMC) (Dr. Calabrese), and six operating research sites including UHCMC, the University of Toledo (Dr. Tamburrino), Columbia University Department of Epidemiology (Dr. Galea), a prestigious research survey firm, Abt SRBI, Inc. with a very long history of military research, the Ann Arbor VAMC Department of Psychiatry at the University of Michigan (Dr Liberzon), and Michigan State University's Biomedical Research and Informatics Center - BRIC (Dr Reed).

With Dr. Calabrese as the coordinating principal investigator, the UHCMC Coordinating Center is responsible for all aspects of project coordination (scientific, administrative, and fiscal) and the conduct of in-person assessments of 300 service members in their local communities annually. With Dr. Tamburrino as project Co-PI, the University of Toledo provides leadership and also conducts in-person assessments of 200 service members in their local communities annually. The Columbia University Department of Epidemiology responsibilities include, but are not be limited to, the design of the project's field procedures, including the annual Telephone Survey and In-Person Survey, scientific manuscript preparation, NIMH grant application, etc. Dr. Galea also serves as the primary interface between the project and the survey firm, Abt SRBI, which carries out the telephone surveys. The University of Michigan Ann Arbor VA Department of Psychiatry is responsible for the design, implementation, and oversight of the Genetics Repository, including laboratory and field procedures for biological sample collection, processing, storage, association analyses, etc. The Michigan State University Biomedical Research Informatics Center provides informatics needs for the In-Person Survey assessments, including data entry and management privileges, enrollment privileges, survey building privileges, etc.

Project #1
The primary study (Project #1) within this Initiative is a clinical epidemiology and health services project and is designed to function as the template upon which other projects, including but not limited to those of a translational research nature, will be superimposed. The first three specific aims of the primary research project were designed to build support and stimulate additional interest in the study of the role of resilience and risk in combat-related posttraumatic psychopathology and other similar adjustment problems.

Specific Aims of Project #1:
1. To study the relationship between deployment-related experiences and the development and trajectory of DSM-IV Axis I diagnoses
2. To document the factors across the life-course that are associated with resilience to DSM-IV Axis I diagnoses and with better post-deployment functioning

3. To study the relationship between National Guard-specific pre-deployment and post-deployment factors and the risk of development of DSM-IV Axis I disorders

Project #1 will interview up to 3,000 members of the Ohio National Guard per year, who were selected at random from the entire population of the Guard. All individuals who participate are interviewed for 1 hour by telephone on an annual basis, which began in November 2008.

A sub-sample of 500 participants of the telephone survey group is also interviewed on an annual basis and in-person, with an average duration of 2-3 hours. This sub-sample allows both for validation of key domains employed in the phone interviews and for further in-depth study of trajectory of psychopathology in this sample. Study personnel recommend that participants bring a family member, friend, or significant other for support and assistance during the interview. Family support often facilitates participant retention throughout the life of the project.

Research visits are conducted at study entry and every 12 months for a minimum of 10 years for both the telephone survey and in person survey.   Currently, Year 4 of data collection is proceeding with the Telephone Survey sample. The participants have variable lengths of involvement and variable combat exposures, allowing us to suitably address the specific aims.

As recommended by the Scientific Advisory Board during the 2010 annual meeting, the investigators began a Dynamic Cohort with the start of Year 3 (November 2010) after receiving appropriate regulatory approvals. The investigators sample new soldiers in the Guard on an annual basis with the intention of replenishing the sample in both the Telephone Survey and the In-Person Survey for participants who are unable to complete the annual survey for reasons including being currently deployed, lost to follow-up, etc.

Research Accomplishments from the Statement of Work for Project #1:
Tasks #1 - #5 from the Statement of Work delineate the critical events that must be accomplished in order for the project to be successful in terms of cost, schedule, and performance. Task #1 has been completed, with Tasks #2 through #5 currently in progress (W81XWH-10-1-0579).

Task #1 – Baseline enrollment of up to 3,000 Ohio National Guard Members in the Telephone Survey, and 500 for the validation In-Person Survey, in order to be able to test Specific Aims #1 -3 with associated hypotheses. Enrollment for the Telephone Survey began 11/18/2008 after the recruitment period. Enrollment for the In-Person Survey began 12/10/2008.   Baseline enrollment into both samples was completed on 11/17/2009 and 12/9/2009 respectively. The Telephone Survey enrolled N=2616, and the In-Person Survey enrolled N=500.

The Dynamic Cohort has increased the overall sample size to N=3,335 in the Telephone Survey and N=626 in the In-Person Survey.

Task #2 – Annual participant follow-up interviews to test Specific Aims #1 -3 with associated hypotheses. Year 4 interviews promptly began after Year 3 ended in late 2011 and are currently ongoing. Cumulative totals are listed in the table below, as of 4/17/2012:.

Total # of interviews:	Telephone Survey	In-Person Survey	Total:
Year 1:	2616	500	3116
Year 2:	1,770	418	2188
Year 3:	1,948	459	2407
Year 4:	790	157	947
Total:	7124	1534	**8658**

Task #3 – Performance of a descriptive analysis of the data collected from the primary and sub-sample group including the prevalence of current mental illness and voluntary triage to OhioCares. At least one peer-reviewed publication per year will be derived from the study data.

We have performed annual analyses on the data collected from the baseline sample, Year 2 sample, and Year 3 sample of participants. For baseline, we examined the broad range of characteristics that are hypothesized to be associated with mental health conditions, as well as potential mediators of these associations. As analyses have been completed, we have presented the results at scientific conferences and submitted manuscripts for peer-reviewed publication.

Significant Findings:

Please see **Appendix A** for all manuscripts that have been submitted to peer-reviewed journals, abstracts are below.

Published manuscripts:

PTSD Comorbidity and Suicidal Ideation Associated With PTSD within the Ohio Army National Guard
OBJECTIVE: To study the relation between PTSD psychiatric comorbidity and suicidal ideation in a representative sample of Ohio Army National Guard soldiers.
METHODS: Using retrospective data collected on the telephone from a random sample of 2616 National Guard soldiers who enrolled in a 10-year longitudinal

study (baseline data collected November 2008 – November 2009), we compared 1) the prevalence of other psychopathologies among those with DSM-IV diagnosed PTSD compared to those without PTSD and 2) the association between PTSD comorbidity and suicidal ideation (reporting thoughts of being better off dead or hurting themselves). All analyses were carried out using logistic regression.

RESULTS: 61.7% of guard members with PTSD in the last year had at least one other psychopathology; 20.2% has at least two other co-occurring conditions. The most common co-occurring psychopathology was depression. While those with PTSD overall were 5.4 (95%CI 3.8 – 7.5) times more likely to report suicidality than those without PTSD, those who had at least two additional conditions along with PTSD were 7.5 (95%CI 3.0 – 18.3) times more likely to report suicidal ideation at some point in their lifetime than those with PTSD alone.

CONCLUSION: Soldiers with PTSD were at increased risk for suicidality and among those with PTSD, those with at least 2 or more additional conditions were at the highest risk of suicidal ideation. Future research should address the mechanisms that contribute to multimorbidity in this population and the appropriate treatment methods for this high-risk group.

Potentially Modifiable Pre-, Peri-, and Postdeployment Characteristics Associated With Deployment-Related Posttraumatic Stress Disorder Among Ohio Army National Guard Soldiers

PURPOSE: To evaluate potentially modifiable deployment characteristics including predeployment preparedness, unit support during deployment, and postdeployment support that may be associated with deployment-related posttraumatic stress disorder (PTSD).

METHODS: We recruited a sample of 2616 Ohio Army National Guard (OHARNG) soldiers and conducted structured interviews to assess traumatic event exposure and PTSD related to the soldiers' most recent deployment, consistent with DSM-IV criteria. We assessed preparedness, unit support, and postdeployment support by using multimeasure scales adapted from the Deployment Risk and Resilience Survey.

RESULTS: The prevalence of deployment-related PTSD was 9.6%. In adjusted logistic models, high levels of all three deployment characteristics (compared with low) were independently associated with lower odds of PTSD. When we evaluated the influence of combinations of deployment characteristics on the development of PTSD, we found that postdeployment support was an essential factor in the prevention of PTSD.

CONCLUSIONS: Results show that factors throughout the life course of deployment in particular, postdeployment support may influence the development of PTSD. These results suggest that the development of suitable postdeployment support opportunities may be centrally important in mitigating the psychological consequences of war.

Coincident posttraumatic stress disorder and depression predict alcohol abuse during and after deployment among Army National Guard soldiers

BACKGROUND: Although alcohol problems are common in military personnel, data examining the relationship between psychiatric conditions and alcohol abuse occurring de novo peri-/post-deployment are limited. We examined whether pre-existing or coincident depression and post-traumatic stress disorder (PTSD) predicted new onset peri-/post-deployment alcohol abuse among Ohio Army National Guard (OHARNG) soldiers.

METHODS: We analyzed data from a sample of OHARNG who enlisted between June 2008 and February 2009. Participants who had been deployed and who did not report an alcohol abuse disorder prior to deployment were eligible. Participants completed interviews assessing alcohol abuse, depression, PTSD, and the timing of onset of these conditions. Logistic regression was used to determine the correlates of peri-/post-deployment alcohol abuse.

RESULTS: Of 963 participants, 113 (11.7%) screened positive for peri-/post-deployment alcohol abuse, of whom 35 (34.0%) and 23 (32.9%) also reported peri-/post-deployment depression and PTSD, respectively. Soldiers with coincident depression (adjusted odds ratio [AOR] = 3.9, 95%CI: 2.0–7.2, $p <$ 0.01) and PTSD (AOR = 2.7, 95%CI: 1.3–5.4, $p <$ 0.01) were significantly more likely to screen positive for peri-/postdeployment alcohol abuse; in contrast, soldiers reporting pre-deployment depression or PTSD were at no greater risk for this outcome. The conditional probability of peri-/post-deployment alcohol abuse was 7.0%, 16.7%, 22.6%, and 43.8% among those with no peri-/post-deployment depression or PTSD, PTSD only, depression only, and both PTSD and depression, respectively.

CONCLUSIONS: Coincident depression and PTSD were predictive of developing peri-/post-deployment alcohol abuse, and thus may constitute an etiologic pathway through which deployment-related exposures increase the risk of alcohol-related problems.

Cigarette smoking and subsequent risk of suicidal ideation among National Guard Soldiers

BACKGROUND: Suicide rates are alarmingly high among military personnel, and particularly Army National Guard soldiers. Smoking is also disproportionately common in the military. Previous studies have suggested that smoking is associated with an increased risk of suicide behavior in the general population. No previous study has assessed whether smoking may be related to increased risk of suicide-related outcomes in the National Guard.

OBJECTIVE: To investigate the relationship between cigarette smoking and suicidal ideation among a representative sample of national guard soldiers.

METHOD: A representative sample of Ohio Army National Guard soldiers were followed prospectively and information was gathered on smoking, suicidal ideation and depression at baseline and one year later.

RESULTS: Smoking at baseline was associated with significantly increased likelihood of suicidal ideation at follow-up (OR=2.0 (1.3, 3.2)). This association persisted after adjusting for demographics and history of depression at baseline, but was no longer statistically significant after adjusting for depression at follow-up.

CONCLUSIONS: Army National Guard soldiers who smoke have a greater risk of subsequent suicidal ideation. Depression concurrent with suicidal ideation appears to explain this relationship. If these results are replicated, screening of soldiers who smoke may be recommended as a proactive step towards mitigating the high risk of suicide in military personnel.

Manuscripts under peer review:

The factor structure of major depression symptoms: A test of four competing models using the Patient Health Questionnaire-9

Little research has examined the underlying symptom structure of major depressive disorder symptoms based on *DSM-IV* criteria. Our aim was to analyze the symptom structure of major depression, using the Patient Health Questionnaire-9 (PHQ-9). The PHQ-9 was administered to a sample of 2,615 Army National Guard soldiers from Ohio. A one-factor model of depression and three separate two-factor models previously established in the literature were evaluated using confirmatory factor analysis. Results demonstrated greater support for the two-factor models of depression than for the one-factor model. The best fitting model was the two-factor model of somatic and non-somatic symptoms supported previously by Krause et al. (2010) and Richardson and Richards (2008). Implications for understanding the components and mechanisms of major depressive disorder are discussed.

Posttraumatic stress disorder and HIV risk behavior among Army National Guard soldiers: The mediating role of depression

We examined the relationship between posttraumatic stress disorder (PTSD) and HIV risk behavior among Ohio Army National Guards (OHARNG), and determined whether depression after a traumatic event mediated this association. We analyzed data collected from a sample of OHARNG enlisted between June 2008 and February 2009. Participants completed interviews assessing HIV risk activities as defined by the Behavioral Risk Factor Surveillance System and were screened for PTSD and depression based on DSM-IV criteria. Logistic regression was used to estimate the direct and indirect effects of PTSD on HIV risk behavior. Of 2,282 participants, 147 (6.4%) reported at least one HIV risk behavior. PTSD was associated with HIV risk behavior (adjusted odds ratio [AOR] = 2.1, 95%CI: 1.1–3.9), as was depression (AOR = 2.2, 95%CI: 1.5–3.2). After depression was included as a mediator, the association between PTSD and HIV risk decreased in magnitude (AOR = 1.8, 95%CI: 0.9–3.4), suggesting partial mediation (Sobel test $p<0.01$). Soldiers with PTSD may be at greater risk of HIV infection due to increased engagement in HIV risk behavior. New onset depression following trauma mediates this relationship. Integrated interventions to address mental health problems and reduce HIV risk behavior are in need of development and evaluation.

Relations Between the Underlying Dimensions of PTSD and Major Depression Using an Epidemiological Survey of Deployed Ohio National Guard Soldiers

In the present study, the authors investigated the relationship between the underlying symptom dimensions of posttraumatic stress disorder (PTSD) and dimensions of major depressive disorder (MDD). A sample of 1,266 Ohio National Guard soldiers with a history of overseas deployment participated and were administered the PTSD Checklist (assessing PTSD) and Patient Health Questionnaire-9 (assessing depression). Using confirmatory factor analysis, results demonstrated that both PTSD's dysphoria and hyperarousal factors were more related to depression's somatic than non-somatic factor; however, PTSD's dysphoria was more related to somatic depression than PTSD's hyperarousal factor. Given PTSD's substantial dysphoria/distress component these results have implications for understanding the nature of PTSD's high comorbidity with depression.

Prevalence of psychopathology and validation of lay-administered mental health assessments in a large National Guard cohort

PURPOSE: To report the reliability and validity of key mental health assessments in an ongoing study of the Ohio Army National Guard (OHARNG).
METHODS: 2616 OHARNG soldiers received hour-long structured telephone surveys including the Posttraumatic Stress Disorder (PTSD) Checklist (PCL-C) and Patient Health Questionnaire – 9 (PHQ-9). A subset (N=500) participated in 2 hour clinical reappraisals, using the Clinician-Administered PTSD Scale (CAPS) and the Structured Clinical Interview for DSM (SCID).
RESULTS: The most commonly reported lifetime conditions were: alcohol abuse 24%, alcohol dependence 23.5%, any depressive disorder 21.4%, and PTSD 9.6%. The telephone survey assessment for PTSD and for any depressive disorder were both highly specific [92% (SE 0.01), 83% (SE 0.02)] with moderate sensitivity [54% (SE 0.09), 51% (SE 0.05)]. Other psychopathologies assessed included alcohol abuse [sensitivity 40%, (SE 0.04) and specificity 80% (SE 0.02)] and alcohol dependence [sensitivity, 60% (SE 0.05) and specificity 81% (SE 0.02)].
CONCLUSION: The baseline prevalence estimates from the telephone study suggest alcohol abuse and dependence may be higher in this sample than the general population. Validity and reliability statistics suggest specific, but moderately sensitive instruments.

Does smoking predict depression onset among military personnel?

BACKGROUND: Recent studies suggest a disproportionately high level of depression in military populations. The reason for this is not known. Smoking is also exceedingly common among soldiers. Several studies have documented a relationship between smoking and increased depression among general population samples. The potential impact of smoking on depression in the military has not been examined.
OBJECTIVES: To investigate the relationship between smoking and depression in a representative sample of Ohio Army National Guard soldiers.

METHOD: A representative sample of Ohio Army National Guard participants were followed prospectively and information was gathered on smoking and depression at baseline and follow-up one year later.

RESULTS: Persistent, active smoking is associated with increased risk of incident depression at follow up. History of smoking in the absence of current smoking at baseline was not associated with depression at follow-up.

CONCLUSIONS: Our results suggest smoking may increase vulnerability to depression onset among military personnel. If replicated, these findings suggest that another benefit to smoking cessation may be decreasing an individual's vulnerability to depression.

Please see **Appendix B** for the data analysis presentation given to the external Scientific Advisory Board during the annual meeting on April 2, 2012. The slides include the following analyses (in addition to results presented above) that have been completed over the past year but have not yet been submitted for publication:

Alcohol dependence and incident suicidal ideation

The aim of this study was to investigate the longitudinal relationship between alcohol dependence and incident suicidal ideation in a representative sample of Ohio Army National Guard soldiers. Accordingly, our sample included the 1587 individuals who reported never having had suicidal ideation. Approximately 6% of individuals qualified for alcohol dependence at wave 1. Among those reporting wave 1 alcohol dependence, 9% reported suicidal ideation at 1-year follow-up, compared to only 2% incident suicidal ideation among those with no baseline alcohol dependence (p=0.0002). 10% of our study sample qualified for wave 1 depression, and among those who qualified for wave 1 depression, 9% had suicidal ideation at 1-year follow-up, as compared to only 2% among those with no depression at baseline (p<0.0001). Although marital status and number of deployments were associated with increased odds of suicidal ideation at follow-up, these effects disappeared in an adjusted model. Specifically, alcohol dependence [AOR=3.44(1.34, 8.8)] and depression [AOR=3.02 (1.35, 6.76)] were independently associated with increased odds of suicidal ideation.

Mental health services utilization

The goal of our analyses on mental health service utilization was to determine the prevalence of service utilization among those with mental health need. Mental health need was defined as ≥ 1 mental health disorder, including PTSD, depression, GAD, or an alcohol use disorder (AUD; including abuse or dependence), or past month suicidal ideation. We examined utilization patterns of individuals who participated in both waves 2 and 3 (n=1319), and looked at prospective associations between mental health need at wave 2 and reported use of services at wave 3. We found that 17% (n=218) had a need for mental health services at wave 2, yet only 37% (n=81) reported any service use at wave 3. Among those reporting any service use, 58% (n=47) reported use of tricare or

VA mental health services. Examining use of services by diagnosis, we found that those with AUD had the lowest use of services – only 23%, while those with PTSD had the highest use of services – 61%. Additionally, we found a dose-response between number of disorders and utilization of services - among those with one disorder, 30% used services; among those with 2 disorders, 50% used services; among those with 3 or more disorders, 55% used services. Interestingly, and in contrast to findings from other samples, gender was not associated with either use of services or use of VA/DoD services. Finally, age was associated with use of VA/DoD services – with the youngest group of individuals least likely to use those services (only 29% of participants ages 17-24) and the oldest group most likely to use those services (85% of participants over 45 years old. In summary, the majority of ONG soldiers who have mental health care need do not report accessing services, greater psychiatric burden was associated with higher utilization of mental health services, and those with AUD also were least likely to use mental health services.

Sexual trauma and psychiatric comorbidity

CONTEXT: As Operation Iraqi Freedom and Operation Enduring Freedom conclude, there is increasing attention on the mental health of returning military personnel. Sexual trauma is highly prevalent nationwide and contributes to mental health difficulties in the general population; however there is a paucity of evidence regarding associations between lifetime sexual trauma and mental health problems among military personnel.

OBJECTIVE: To document the prevalence of sexual trauma and its associated mental health consequences among three representative samples of soldiers.

DESIGN: Data were drawn from a national sample of Reserve soldiers, a national sample of Guard soldiers as well as a state-level sample of Ohio Army National Guard soldiers.

PARTICIPANTS: One-thousand thirty Reserve soldiers (77% male), 973 National Guard (NG) soldiers (85% male), and 2,616 Ohio Army National Guard (OHARNG) soldiers (85% male) completed structured interviews.

MAIN OUTCOME MEASURES: Participants responded to questions about their lifetime experience of rape or sexual assault and follow-up questions about whether the sexual trauma had occurred during their most recent deployment. Participants also responded to modules assessing current and lifetime posttraumatic stress disorder (PTSD) and depression.

RESULTS: Lifetime sexual trauma prevalence was 36.6%, 25.5%, and 36.3% in the Reserve, NG, and OHARNG women samples, respectively, and 4.0%, 3.9%, and 5.0% for Reserve, NG, and OHARNG men, respectively. Among soldiers reporting lifetime sexual trauma, 2.4-7.1% of women and 0-4.5% of men reported deployment-related sexual trauma. For sexual trauma victims, odds of meeting criteria for current or lifetime PTSD ranged from 3.3 to 7.5, and odds of meeting criteria for current or lifetime depression ranged from 1.7 to 5.0.

CONCLUSIONS: Sexual trauma prevalence estimates among female reservists were consistent with other military samples, but substantially higher than general population prevalence estimates. Estimates among men were consistent with

population prevalence estimates. The vast majority of sexual trauma reported is not deployment related. Findings point to a strong need to screen for lifetime sexual trauma experiences and associated mental health sequelae in military samples.

The following twelve topics are undergoing analysis with manuscripts in process:

- Baseline prevalence of Axis I conditions in the in-person survey sample
- Ethics in trauma research: participant reactions to trauma questions in the Ohio National Guard
- PTSD symptom differences after war-related and civilian-related potentially traumatic events in military personnel
- Incident alcohol disorder and mental health conditions
- Suicidal ideation after war-related and civilian-related potentially traumatic events in military personnel.
- Alcohol abuse and dependence in the Ohio National Guard
- War and civilian PTSD and criterion A2
- Interface between childhood trauma, socioeconomic status, and comorbidities
- Risky Behaviors in the Ohio National Guard sample
- Risky Behaviors and Suicidal Ideation
- Child Abuse and Depression
- Pre-, peri- and post-deployment factors and the incidence of alcohol abuse during or after deployment

Summaries of the first 5 analyses:

<u>Baseline prevalence of Axis I conditions in the in-person survey sample</u>
One of the unique characteristics of the OHARNG MHI is the annual collection of data on all DSM-IV Axis I disorders. Using the Structured Clinical Interview for DSM-IV-TR, a full clinical diagnostic panel was administered to 500 randomly selected OHARNG soldiers. In this paper we outline the baseline prevalences of these conditions as well as how these prevalences differ by deployment status. The most common condition ever present was alcohol abuse (28.2%), followed by major depressive disorder (22.4%), alcohol dependence (20.4%) and drug use disorder (15.6%). Lifetime prevalence rates of mental health disorders were 66.4% and current prevalence rates were 24.4% in the OHARNG. The most prevalent lifetime disorders were alcohol abuse (28.2%), major depressive disorder (22.4%), and alcohol dependence (12.5%), while the most prevalent current disorders were generalized anxiety disorder (5.0%), major depressive disorder (4.8%) and alcohol abuse (3.4%). In addition, the most prevalent lifetime classes of disorders were substance use disorders (52.2%), mood disorders (30.0%), and anxiety disorders (19.6%), while for current prevalent classes of disorders were anxiety disorder (13.8%), mood disorders (7.6%), and substance use disorder (7.0%). In those who have never been deployed the highest lifetime prevalence was substance use disorders (44.2%) and for current disorders it was anxiety disorders (11.7%). Those who were deployed were more

likely to have PTSD (p<0.01) and alcohol abuse (p<0.01). The longitudinal follow-up of this in-person cohort will provide a detailed measure of the trajectories of all Axis I conditions among National Guard soldiers. This information will be pivotal in understanding the needs of reserve forces during the reintegration period of the soldier from war to civilian life.

Ethics in trauma research: participant reactions to trauma questions in the Ohio National Guard

Several studies have shown that participants in trauma research generally appreciate their research engagement and do not suffer inadvertent adverse effects (Griffin, Resick, Waldrop & Mechanic, 2003). However, this has not been examined in military populations. We evaluated the effects of asking Ohio National Guard (ONG) members to recall details of their trauma exposure, and to determine factors that may put participants at risk of becoming upset by such assessments. Of 500 participants, 17.2% (n=86) reported being upset during the survey and 7.0% (n=6) of those reported still being upset at the end of the session. The following diagnostic groups were more likely to report being upset by any of the survey questions: 36.2% of those with a history of childhood physical abuse (p<.0001), 33.9% of those with a history of childhood physical neglect (p=0.0004), 37.1% of those with a history of childhood emotional abuse (p<.0001), and 47.5% of those with a history of childhood sexual abuse (p<.0001); 34% of those with suicidal ideation (p=.001); 37.3% of those participants who were female gendered (p<.0001); 24.4% of those participants who had a male-gendered interviewer (p=.0002); 22.5% of those who were the same gender as their interviewer (p=.0057); 31.8% of those who had Major Depressive Disorder (p<.0001), 37.5% of those who had Generalized Anxiety Disorder (p=.013), 50.0% of those who had Bipolar Disorder (p=.0023), 21.2% of those who had an alcohol use disorder (p=.0274), 28.6% of those who had a drug use disorder (p=.0045), and 61.3% of those who had Posttraumatic Stress Disorder (p<.0001). Most research participants were not upset as a result of the survey. Of the few participants who were upset by interview questions, those with mental health disorders were most likely to report being upset during the course of the interview, with only a small percentage still upset by the end of the interview. We did not find statistically significant differences from the following factors: high level of interpersonal conflict (found in the Conflict Tactics Scale), activity-limiting physical or emotional pain, number of deployments (stateside and overseas), marital status, employment, and socioeconomic status. Further research should be conducted to determine how a participant's emotional state at the end of an interview affects his/her continued participation in the research project. Also, it should be determined how elapsed time from the trauma to the interview affects a participant's emotional reaction to recounting the details of his/her trauma.

PTSD symptom differences after war-related and civilian-related potentially traumatic events in military personnel

There is evidence that different types of potentially traumatic events can result in varying symptoms of PTSD. Given the differences between war- and civilian-related traumatic events, it is possible that war-related and civilian-related PTSD may present with different symptoms. We used latent-class analysis to compare the pattern and distribution of the 17 PTSD symptoms to find similar groups (latent classes) of individuals with war-related and civilian-related potentially traumatic events. After identifying individuals with the highest score of symptoms from the latent class analysis, we compared the odds of each PTSD symptom between those with war vs. civilian related PTSD using multivariable logistic regression adjusting for gender, age, marital status, total experience of traumatic events and the time since the traumatic event. Those with war-related potentially traumatic events were more likely to have symptoms of physiologic reactivity (OR 5.59 95%CI 1.51-20.8), diminished interest in activities (OR 3.49, 95% CI 1.24-9.80) and feeling numb (OR 3.82, 95% CI 1.18 – 12.4). Future research should examine the implications of these increased symptoms among those with war-related events including possible link to more chronic conditions or co-morbidity.

Incident alcohol disorder and mental health conditions
Alcohol use disorders are common in military personnel; however, it is unclear if mental health conditions increase the risk of during and post deployment alcohol abuse among this population. Ohio National Guards were randomly selected to complete computer assisted telephone interviews between June 2008 and February 2009. The primary outcome was reporting alcohol abuse meeting DSM-IV criteria first occurring during or post-deployment. Primary exposures of interest included during-/post-deployment major depressive disorder (MDD) and posttraumatic stress disorder (PTSD). Predictive logistic regression was used to determine the independent correlates of during-/post deployment alcohol abuse. Of 963 deployed participants, 113 (12%) screened positive for during-/post-deployment alcohol abuse, of whom 35 (34%) and 23 (33%) also reported during-/post-deployment MDD and PTSD, respectively. In a multivariate model MDD (adjusted odds ratio [AOR] = 3.89, 95%CI: 2.12-7.15, $p<0.001$) and PTSD (AOR=2.73, 95%CI: 1.37–5.42, $p=0.004$) were associated with alcohol abuse. The conditional probability of during-/post-deployment alcohol abuse was 7%, 16%, 22%, and 43% among those with no MDD/PTSD, PTSD only, MDD only, and both PTSD and MDD, respectively. We observed a high prevalence of during-/post-deployment alcohol abuse among Ohio National Guardsmen. Concurrent mental health conditions were highly predictive of developing alcohol abuse, and thus may constitute an etiologic pathway through which deployment-related exposures increase the risk of alcohol problems.

Suicidal ideation after war-related and civilian-related potentially traumatic events in military personnel.
There is recent evidence that the rate of suicide among Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) is increasing compared to the general population. While it is well known that PTSD is a risk factor for suicidal outcomes (suicidal ideation, attempted suicide and completed suicide) little is

known about how the event that leads to PTSD may then be associated with suicidal ideation. Specifically, it is unclear how war-related PTSD and civilian-related PTSD are associated with suicidal ideation. We used the baseline results from the telephone sample (N=2616) of the OHARNG MHI to compare the association between PTSD and suicidality for those with war-related traumatic events and those with civilian-related trauma. Among veterans with war-related traumatic events, having PTSD was minimally associated with suicidal ideation, adjusting for history of mental illness and other covariates (AOR 0.943, 95% CI 0.253 – 3.52). In contrast, there was an adjusted association between PTSD status and suicidal ideation among veterans with civilian traumatic events (AOR 4.47, 95% CI 2.04 – 9.82), and association persisted when the analysis was limited to assaultive events only (AOR 15.1, 95% CI 3.14 – 72.3). This highlights that suicide rates in the army may not be linked to increased rates of PTSD from returning OIF and OEF veterans. Future studies should confirm these findings that it is civilian-related PTSD that links to suicidal thoughts as compared to war-related PTSD.

Task #4 – Annual oversight meetings for the Initiative.
The *External Scientific Advisory Board*, consisting of nationally and internationally renowned individuals with strong scientific backgrounds providing critical feedback on the scientific merit of the project, is held on an annual basis. The most recent meeting was held on April 2, 2012 (see Appendices B & C for the SAB slide presentations). The primary recommendations resulting from the recent SAB meeting were further analyses of the existing data, as well as ideas on how to shift the current study to a translational focus. The manuscripts under peer review were circulated to the SAB members for feedback.

The *Administrative Advisory Board (AAB)*, consisting of state and local leaders, administrators, and stakeholders providing guidance on non-scientific issues,is held on an annual basis. The 2012 annual meeting for the Administrative Advisory Board is scheduled for Wednesday May 16, 2012 at Beightler Armory in Columbus Ohio. The meeting will focus on the translational slides presented at the Scientific Advisory Board meeting and will focus on discussion of appropriate interventions. Representatives from the following will be in attendance:
- Leadership of OHARNG including TAG MG Ashenhurst and brigade commanders
- Ohio Dept of Mental Health
- Ohio Dept of Veterans Services
- Ohio Dept of Alcohol & Drug Addiction Services
- Ohio Assoc of County Behavioral Health Authorities
- Veteran's Affairs
- Columbus Veteran Center

Task # 5 – Financial Reporting is due quarterly via SF425 and has been submitted regularly and on schedule for the duration of the project. The most

recent report was submitted on April 12, 2012 for the first quarter 2012. Additionally, the most recent Quarterly Report was submitted to TATRC and USAMRAA on April 12, 2012 for the first quarter 2012.

Project #2

The Genetics Repository component (Project #2) is a study on genetic determinants of risk and resilience to the development of PTSD and other mental illnesses. This translational project involves the creation of a repository of saliva DNA samples, which are being used to perform genetic association studies on selected candidate alleles and potentially genome-wide analyses at multiple levels. These may include cross-sectional genetic association analyses of pre-deployment traits, longitudinal analyses to investigate genetic markers and functional polymorphisms involved in vulnerability to deployment-related psychiatric disorders (i.e. in case-control association analyses), as well as building models incorporating measures of deployment-related and pre-deployment environmental factors for vulnerability (i.e. gene x environment interactions). This design allows for integrated research utilizing neuroimaging, psychophysiological, and neuroendocrine measures to investigate the effects of genetic variants on cognitive, behavioral, and physiological function at baseline and after deployment stressors.

Research Accomplishments from the Statement of Work for Project #2:
Task #1 – In order to test the 2 hypotheses in the Genetics Protocol, the participants in the Telephone Survey of Project #1 have been approached to participate in the Genetics Repository and were asked to submit a saliva sample via a kit mailed to them. Recruitment continues as part of the Year 3 and Year 4 Telephone Survey, as well as the Dynamic Cohort Year 2. Recruitment will continue until all original and dynamic cohorts have been approached. As of April 17, 2012, 76% of participants have agreed to receive the Genetics kit in the mail after their Telephone Survey (N=1886 out of 2476) and 53% have returned their saliva sample, self report questionnaire, and consent form (N=1003 out of 1886).

Task #2 – Upon receipt of saliva samples, the lab at the Ann Arbor VA processes them appropriately to provide genomic DNA preparation of the samples. Recently, the Ann Arbor VA site has begun analyses of the samples and phenotype data from Project 1.

Please see **Appendix C** for the recent data slide presentation to the Scientific Advisory Board during the annual meeting on April 2, 2012. Preliminary analyses continue for the remainder of the samples not previously processed.

KEY RESEARCH ACCOMPLISHMENTS

1. Completion of Year 1 (beginning November 2008) of data collection
   - Telephone Survey N=2616
   - In-Person Survey N=500
2. Completion of Year 2 (beginning November 2009).
   - Telephone Survey N=1770
   - In-Person Survey N=418
3. Year 3 Telephone Survey data collection proceeding (beginning November 2010) and completion of Year 3 In-Person Survey data collection:
   - Telephone Survey N=1948 interviews completed thus far as of April 17, 2012
     - Year 3 follow up interviews: N=1370
     - Dynamic Cohort baseline interviews (closed December 2011): N=578
   - In-Person Survey N=458
     - Year 3 follow up interviews: N=354
     - Dynamic Cohort baseline interviews: N=104
4. Year 4 data collection proceeding (beginning November 2011)
   - Telephone Survey N=790 interviews completed thus far as of April 17, 2012
     - Year 4 follow up interviews: N=649
     - Dynamic Cohort baseline interviews: N=141
     - In-Person Survey N=157 interviews completed thus far as of April 17, 2012
       - Year 4 follow up interviews: N=139
       - Dynamic Cohort baseline interviews: N=18
5. Genetics Repository data collection (began May 2010) as of April 17, 2012:
   - Agreed to receive Genetics kit: N=1886 out of 2476 (76%)
   - Returned completed Genetics kit: N=1003 out of 1886 (53%)
6. The Annual Scientific Advisory Board Meetings was held most recently on April 2, 2012 (see Appendices B & C for slide reprints). Previous meetings were held on, beginning in 2009 as data collection began November 2008: May 4, 2009; April 26, 2010; and May 24, 2011.
7. The current year's Administrative Advisory Board Meeting is scheduled for May 16, 2012. Previous meetings were held on: October 23, 2009 and May 25, 2011.
8. Four published manuscripts: Calabrese et al (2011), Goldman et al (2012) Marshall et al (in press), and Goodwin et al (in press). Please see Appendix A.
9. Disseminated data through professional meetings (i.e. ISTSS, SER, APA, NASW) and Ohio based meetings. Please see *Presentations* within the Reportable Outcomes section below for a comprehensive list.

REPORTABLE OUTCOMES

*Manuscripts published over the past year (see **Appendix A** for reprints):*
1) Calabrese J, Prescott M, Tamburrino M, Liberzon I, Slembarski R, Goldmann E, Shirley E, Fine T, Goto T, Wilson K, Ganocy S, Chan P, Serrano M, Sizemore J, and Galea S. (2011). PTSD Comorbidity and Suicidal Ideation Associated With PTSD within the Ohio Army National Guard. *Journal of Clinical Psychiatry*, 72(8), 1072-1078.
2) Goldmann, E., Calabrese, J. R., Prescott, M. R., Tamburrino, M., Liberzon, I., Slembarski, R., Galea, S. (2012). Potentially modifiable pre-, peri-, and postdeployment characteristics associated with deployment-related posttraumatic stress disorder among ohio army national guard soldiers. *Annals of Epidemiology, 22*(2), 71-78.
3) Marshall, B. D. L., Prescott, M. R., Liberzon, I., Tamburrino, M. B., Calabrese, J. R., & Galea, S. (in press). Coincident posttraumatic stress disorder and depression predict alcohol abuse during and after deployment among army national guard soldiers. *Drug and Alcohol Dependence*
4) Goodwin RD, Prescott M, Tamburrino M, Calabrese JR, Liberzon I, Galea S (in press). Cigarette smoking and subsequent risk of suicidal ideation among National Guard Soldiers. *Journal of Affective Disorders*

*Manuscripts currently under peer review (see **Appendix A** for drafts under review):*
5) Elhai J, Contractor A, Tamburrino M, Fine T, Prescott M, Shirley E, Chan P, Slembarski R, Liberzon I, Galea S, and Calabrese J. (2011) The factor structure of major depression symptoms: A test of four competing models using the Patient Health Questionnaire-9. *Psychiatry Research*, submitted 9/1/2011, response to comments and resubmission 2/20/2012.
6) Marshall B, Prescott M, Liberzon I, Tamburrino M, Calabrese J, Galea S. (2012). Posttraumatic Stress Disorder and HIV Risk Behavior among Army National Guard Soldiers: The Mediating Role of Depression. *Journal of Traumatic Stress*, submitted 12/20/2011
7) Biehn TL, Contractor A, Elhai JD, Tamburrino M, Fine TH, Shirley E, Chan PK, Slembarski R, Liberzon I, Calabrese J, and Galea S. (2012). Relations Between the Underlying Dimensions of PTSD and Major Depression Using an Epidemiological Survey of Deployed Ohio National Guard Soldiers. *Journal of Abnormal Psychology*, submitted 2/21/2012.
8) Prescott M, Tamburrino M, Calabrese J, Liberzon I, Slembarski R, Goldmann E, Shirley E, Fine T, Goto T, Wilson K, Ganocy S, Chan P, Derus A, Serrano M, Sizemore J, and Galea S. (2012). The Ohio Army National Guard Mental Health Initiative: Data Collection, Sampling, Validation and Baseline Results. *Annals of Epidemiology,* submitted 3/4/2012.

9) Goodwin RD, Prescott M, Tamburrino M, Calabrese J, Liberzon I, and Galea S. (2012). Does smoking predict depression onset among military personnel? *Addiction*, submitted 4/2012.

*Abstracts submitted over the past year (see **Appendix D** for reprints and References for all abstracts submitted since the beginning of the project):*
1) American Psychiatric Association Annual Conference May 2012. The Ohio Army National Guard Mental Health Initiative: Prevalence of DSM-IV Disorders. Tamburrino, M. Submitted December 2011, accepted 2/6/2012.
2) Society for Epidemiologic Research 2012 Annual Meeting. Posttraumatic stress disorder and HIV risk behavior among Army National Guard Soldiers: The mediating role of depression. Marshall, B. Submitted December 2011, accepted 3/29/2012.
3) XIX International AIDS Conference. Posttraumatic stress disorder and HIV risk behavior among Army National Guard Soldiers: The mediating role of depression. Marshall, B. Submitted December 2011, accepted.
4) The following abstracts were submitted in February-March 2012 for consideration at the International Society for Traumatic Stress Studies 28th Annual Meeting in November 2012:
    a. Poster: Participant Reactions to Trauma Questions in the Ohio Army National Guard (OHARNG). Fine, T. Submitted February 2012
    b. Symposia: Relations Between the Underlying Dimensions of PTSD and Major Depression Using an Epidemiological Survey of Deployed Ohio National Guard Soldiers. Elhai, E. Submitted March 2012.
    c. Symposia: Child abuse and psychopathology developed during deployment in a sample of National Guard soldiers. Prescott, M. Submitted March 2012

Presentations:
1) Oral presentations:
    a) Ohio Army National Guard Mental Health Initiative: Suicide Data. Calabrese, J. OhioCares Subcommittee, Suicide Prevention Workgroup, August 2011
    b) Content Expert on Resilience and provided an overview of the study results from the Ohio Army National Guard Mental Health Initiative. Tamburrino, M. Air Force Research Laboratory Resilience Workshop, September 2011.
    c) PTSD Comorbidity and Suicidal Ideation Associated With PTSD within the Ohio Army National Guard. Calabrese, J. American Psychiatric Association Annual Conference in May 2011.
    d) Testimony submitted to the Defense Health Board on "OHARNG Completed Suicides, Preliminary Project Data, and ONG Suicide Prevention Training" in January 2010.

e) Ohio National Guard Annual Commanders Call Meeting on February 27, 2010 presented by Marijo Tamburrino, MD

f) Ohio State University/VA/ONG Conference: "Responding to the Needs of Ohio Veterans: Essential Tools to Address those Facing Deployment and Reintegration" on May 14, 2010 presented by Marijo Tamburrino, MD

g) Operation Reconnect: "Understanding the Needs of Military Service Members & Their Families" on June 11, 2010 presented by Marijo Tamburrino, MD

h) Symposia presentation at the International Society for Traumatic Stress Studies 26th Annual Conference in November 2010, Montreal, Canada. Symposia composed of the following topics:
   1) Ohio National Guard Mental Health Initiative. Galea S.
   2) The Ohio National Guard Mental Health Initiative: baseline collection of a ten-year longitudinal cohort. Tamburrino M.
   3) PTSD Comorbidity and Suicidal Ideation Associated with PTSD within the Ohio Army National Guard. Calabrese J.
   4) PTSD Symptoms after war- and civilian-related traumas. Prescott M.
   5) A "lifecourse" perspective on pre-, peri-, and post-deployment characteristics associated with the risk of posttraumatic stress disorder among Ohio Army National Guard soldiers. Galea S.

2) Poster presentations:
   a) Mental health disorders increase the risk of during and post-deployment alcohol abuse among Ohio Army National Guards Marshall, B. International Society for Traumatic Stress Studies 27th Annual Meeting. November 2011.
   b) Risky driving behavior among Ohio Army National Guard soldiers. Hoggatt K. Society for Epidemiologic Research in June 2011.
   c) Baseline Results and Validation Methods of a 10 year Longitudinal Study of the Ohio Army National Guard. Tamburrino M. American Psychiatric Association Annual Conference in May 2011.
   d) Baseline Results and Validation Methods of a 10 year Longitudinal Study of the Ohio Army National Guard. Tamburrino M. All Ohio Institute of Community Psychiatry Annual Conference on March 25-26, 2011, Cleveland Ohio.
   e) Ethics in trauma research: participant reactions to trauma questions in the Ohio National Guard. Wilson K. National Association of Social Workers Ohio Chapter Annual Conference October 2010, Columbus Ohio. *Winner of first place award.*
   f) Society for Epidemiological Research June 2010 annual meeting:
      i. War-related PTSD: the context of trauma and symptoms of posttraumatic stress disorder in the National Guard. Prescott, M. *Second place research award*

      ii. Social and military characteristics associated with the co-occurrence of psychopathology among National Guard soldiers. Prescott, M

      iii. Pre-, peri-, and post-deployment characteristics and the risk of posttraumatic stress disorder among Ohio National Guard soldiers. Goldmann, E.

  g) Society for Epidemiological Research 2009 annual meeting (poster): Deployment characteristics, combat, and posttraumatic stress disorder among National Guard Members. Prescott, M.

Licenses applied for and issued:
1) Childhood Trauma Questionnaire
2) Conflict Tactics Scale
3) Military Acute Concussion Evaluation and Post Deployment Health Assessment Form DD2789 (MACE)
4) Resilience Scale
5) Structured Interview for DSM-IV (SCID)
6) Spiritual Well Being Scale
7) SF (Short Form) -12

Degrees obtained that were supported by this award:
1) Marta Prescott, PhD – Dr. Prescott was supported by the University of Michigan site budget and served as the Telephone Survey Data Analyst and Project Manager until late 2011 when she defended her dissertation, utilizing project data.

Development of Repositories:
1) Genetics Repository at Ann Arbor VA – saliva DNA samples

Informatics:
1) Michigan State University's RIX database and electronic data capture system (including the SCID and CAPS) for the In-Person Survey
2) Abt SRBI, Inc.'s CATI database for the Telephone Survey

Research opportunities received based on training supported by this award:
1) Neuroimaging and Genetic Investigation of Resilience and Vulnerability to PTSD, ancillary study started in 2011, funded by University of Toledo internal funds. Xin Wang, PhD, began on the project as a research fellow at the University of Toledo, and Israel Liberzon, MD and Anthony King, PhD mentored him at the Ann Arbor VA site during his fellowship. This ancillary project is done in conjunction between the University of Toledo and the Ann Arbor VA sites.

Funding applied for based on work supported by this award:

Submission Date	Funding Agency / Mechanism	Proposal Title	Outcome
Sep-07	FY07 DOD PTSD/ TBI	A Prospective Study of Genetic, Environmental, and Neural Predictors of Deployment-related PTSD using an Emotional fMRI Paradigm	Grant reviewed, not funded
Sep-07	CDMRP: FY07 DOD PTSD/TBI	Pilot Study for Developing Prospective, Longitudinal Genetic Association Studies of Risk and Resilience for Deployment-related PTSD	Grant reviewed, not funded
Jun-08	NIMH: R01	Prospective Study of Combat PTSD: Genetic, Development & Neuroimaging Predictors	Grant reviewed, not funded
May-09	NIMH: RC2 GO grant	Genetics of Risk for PTSD in OEF/OIF Veterans: GWAS and Targeted Re-sequencing of Genomic Risk Regions.	Grant reviewed, not funded
Aug-09	CDMRP Psychological Health and Traumatic Brain Injury (PH/TBI) Research Program: Advanced Technology/Therapeutic Development Award W81XWH-09-PH/TBIRP-AT/TDA)	Resiliency Index for Post-deployment PH & TBI in OEF/OIF soldiers: Genome-wide Association, Childhood Adversity, & Brain Structure studies	LOI submitted, not selected for full submission
Sep-09	CDMRP FY 2010 DoD PTSD / TBI	Resiliency Index for Post-deployment Psychological Health in OEF/OIF Soldiers Using Genome Wide Genetic and Predeployment Psychosocial Data	LOI accepted (25%), full application submitted 12/18/09, not funded
Sep-09	DMRDP FY10: Applied Research & Advanced Technology Award (W81XWH-09-DMRDP-ARATDA)	Longitudinal Symptoms and Military/Civilian Functional Impairments in Ohio National Guard Comorbid for PTSD and TBI	LOI submitted, not selected for full submission
Nov-10	University of Toledo Translational Research Stimulation Award	Neuroimaging and Genetic Investigation of Resilience and Vulnerability to PTSD	Internally funded
Jan-11	NIH: Social Environment (R01 RFA-DA-11-003)	Social environment and substance use: Using EMA to understand mechanisms	Grant reviewed, not funded
Oct-11	NIH: R01	Social environment and substance use: Using EMA to understand mechanisms	Grant reviewed, not funded
Dec-11	NIH: Mechanistic Pathways Linking Psychosocial Stress and Behavior (R01 - RFA-HL-12-037)	Mechanistic Pathways Linking Psychosocial Stress and Behavior	Pending

CONCLUSION

This project has provided the military with novel, long-term, prospective data on the National Guard, traditionally an understudied military population. More than 13,000 Ohio Army and Air National Guard have been deployed for both national and international duty since September 11, 2001. The magnitude of this contribution makes Ohio fifth in the nation in the size of its National Guard reserve component contribution deployed internationally and nationally. These factors make Ohio an integral location amongst the military, and for this reason, the OHARNG MHI has been well positioned to study this important population, the data from which may have a national impact considering the high utilization of the National Guard in recent wars.

The Initiative's accomplishments include the following. Operationally, the project has built a four wave unique dynamic cohort of Ohio National Guard members combining extensive exposure, phenotypic, and genotypic data. Scientifically, the investigators have re-conceptualized the standard approach to the health of reserve forces through a pre-, peri-, and post-deployment continuum. Findings have focused on guard support and risk of psychopathology, risk behavior, substance use, and mental health services. As mentioned in this report, the investigators are continuing Wave 4 data collection, data analyses, and manuscript publication through W81XWH-10-1-0579, which was awarded to continue the existing scope of work for the OHARNG MHI.

Since project conceptualization in 2007, the Initiative has evolved from a clinical epidemiology and genetics project to a focus on translational research, bridging the link between science and practice. One of the study design's most unique components is that areas of unmet need in mental health illness have been identified in real time, allowing the Ohio National Guard leadership to intervene and help improve the lives of soldiers on an ongoing basis throughout the study. For example, in early 2010, the ONG expressed a desire to better understand how to predict the development of suicidal thoughts and suicide attempts in soldiers with PTSD. Based on this desire, analyses were conducted that elucidated the most important predictors of suicide in soldiers with PTSD compared to soldiers without PTSD. These analyses determined that there is a significant increase in suicidal thoughts in soldiers with PTSD who also have co-occurring symptoms of depression, generalized anxiety, and alcohol use disorder. As these other disorders compound PTSD, the risk for suicidal thoughts increase dramatically. With this knowledge, the ONG has implemented programs in place to better manage this likelihood, such as specific enrichments to the ONG Suicide Prevention Training Program.

Based on the success of the enrichments to the Suicide Prevention Training Program, the investigators and leadership of the Ohio National Guard have worked collaboratively in the design phase for waves 3 and 4. The Guard has proposed areas of special interest to be prioritized to potentially change operational procedures, including soldier training:

- The effectiveness and success of the ONG's Battle Buddy Program
- The role of Axis I comorbidity in suicide, not only PTSD, but depressive episodes and alcohol use

Specifically over the past year, the investigators have continued to focus on alcohol use disorders as an area of unmet need in the military. For example, 10% of our study sample qualified for wave 1 depression, and 9% of those soldiers had suicidal ideation at the 1-year follow-up, as compared to only 2% among those with no depression at baseline (p<0.0001). Additionally, among those reporting wave 1 alcohol dependence (6% of N=1587 without depression or prior suicidal ideation), 9% reported suicidal ideation at 1-year follow-up, compared to only 2% incident suicidal ideation among those with no baseline alcohol dependence (p=0.0002). These results highlight the need for further study, prevention, and intervention of alcohol use disorders in the military.

The investigators will be submitting proposals for further funding in order to continue this translational science approach. In particular, to extend the epidemiologic observations to *trajectories* of psychopathology, risk behavior, and substance use, and combining the genetic and environmental data over the life-course and trajectories of phenotypes. We envision a translational science approach that develops an individualized healthy warrior program. This program will entail personalized training for vulnerable sub-groups and promotes a sophisticated understanding of how genetic vulnerability combines with exposure vulnerability to identify subgroups at risk. To begin this endeavor, an alcohol use intervention study, targeting secondary prevention, is being conceptualized and will be submitted for scientific review over the summer of 2012.

REFERENCES

Bibliography of all publications and meeting abstracts resulting from research effort (see Appendices A & D for reprints):

Baker, D., Neylan, T., Vasterling, J., & Calabrese, J. R. (December 2011). Panel presentation: Identifying predictors of trauma response: State of the art of current prospective studies of PTSD: Psychiatric comorbidity in the baseline sample of 2,616 soldiers in the ohio army national guard study of combat mental health [Abstract].
American College of Neuropsychopharmacology (ACNP) 50th Annual Meeting

Biehn, T., Contractor, A., Elhaj, J., Fine, T., & Tamburrino, M. Symposia: Relations between the underlying dimensions of PTSD and major depression using an epidemiological survey of deployed ohio national guard soldiers [Abstract].
International Society for Traumatic Stress Studies 28th Annual Meeting

Calabrese, J. R., Prescott, M., Tamburrino, M., Liberzon, I., Slembarski, R., Goldmann, E. et al. (2011a). Baseline results and validation methods of a 10 year longitudinal study of the ohio army national guard. [Abstract].
American Psychiatric Association 2011 Annual Conference

Calabrese, J. R., Prescott, M., Tamburrino, M., Liberzon, I., Slembarski, R., Goldmann, E. et al. (2011b). Psychiatric comorbidity in the baseline sample of 2,616 soldiers in the ohio army national guard study of combat mental health. [Abstract].
American Psychiatric Association 2011 Annual Conference

Calabrese, J. R., Prescott, M., Tamburrino, M., Liberzon, I., Slembarski, R., Goldmann, E. et al. (March 2011). Baseline results and validation methods of a 10 year longitudinal study of the ohio army national guard. [Abstract].
All Ohio Institute on Community Psychiatry Meeting

Calabrese, J. R., Prescott, M., Tamburrino, M., Liberzon, I., Slembarski, R., Goldmann, E., et al. (2011). PTSD comorbidity and suicidal ideation associated with PTSD within the ohio army national guard. *The Journal of Clinical Psychiatry, 72*(8), 1072-1078.

Calabrese, J. R., Tamburrino, M., Galea, S., Prescott, M., & Liberzon, I. (November 2010). Symposia presentation: PTSD comorbidity and suicidal ideation associated with PTSD within the ohio army national guard. [Abstract].
International Society for Traumatic Stress Studies 26th Annual Conference

Fine, T., Tamburrino, M., Wilson, K., Shirley, E., Goto, T., Chan, P. et al. Participant reactions to trauma questions in the ohio army national guard (OHARNG) [Abstract].
International Society for Traumatic Stress Studies 28th Annual Meeting

Galea, S., Prescott, M., Tamburrino, M., Liberzon, I., & Calabrese, J. R. (November 2010a). Symposia presentation: A "lifecourse" perspective on pre-, peri-, and post-deployment characteristics associated with the risk of posttraumatic stress disorder among ohio army national guard soldiers. [Abstract].
International Society for Traumatic Stress Studies 26th Annual Conference

Galea, S., Prescott, M., Tamburrino, M., Liberzon, I., & Calabrese, J. R. (November 2010b). Symposia presentation: Ohio national guard mental health initiative. [Abstract].
International Society for Traumatic Stress Studies 26th Annual Conference

Goldmann, E., Tamburrino, M., Liberzon, I., Slembarski, R., Prescott, M., Calabrese, J. R. et al. (2010). Pre-, peri-, and post-deployment characteristics and the risk of posttraumatic stress disorder among ohio national guard soldiers. [Abstract].
Society for Epidemiological Research Annual Meeting

Goldmann, E., Calabrese, J. R., Prescott, M. R., Tamburrino, M., Liberzon, I., Slembarski, R., et al. (2012). Potentially modifiable pre-, peri-, and postdeployment characteristics associated with deployment-related posttraumatic stress disorder among ohio army national guard soldiers. *Annals of Epidemiology, 22*(2), 71-78.

Goodwin RD, Prescott M, Tamburrino M, Calabrese JR, Liberzon I, Galea S (in press). Cigarette smoking and subsequent risk of suicidal ideation among National Guard Soldiers. *Journal of Affective Disorders*.

Hoggatt, K. J., Goldmann, E., Prescott, M., Calabrese, J. R., Tamburrino, M., Liberzon, I. et al. (2011). Risky driving behavior among ohio army national guard soldiers. [Abstract].
Joint Epidemiology Congress

Marshall, B., Prescott, M., Liberzon, I., Tamburrino, M., Calabrese, J. R., & Galea, S. Posttraumatic stress disorder and HIV risk behavior among army national guard soldiers: The mediating role of depression [Abstract].
XIX International AIDS Conference

Marshall, B., Prescott, M., Liberzon, I., Tamburrino, M., Calabrese, J. R., & Galea, S. (2012). Posttraumatic stress disorder and HIV risk behavior among

army national guard soldiers: The mediating role of depression [Abstract].
Society for Epidemiologic Research 2012 Annual Meeting

Marshall, B. D. L., Prescott, M. R., Liberzon, I., Tamburrino, M. B., Calabrese, J. R., & Galea, S. Coincident posttraumatic stress disorder and depression predict alcohol abuse during and after deployment among army national guard soldiers. *Drug and Alcohol Dependence,* in press.

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Prescott, M., Tamburrino, M., Liberzon, I., Calabrese, J. R., Chan, P., Slembarski, R. et al. Symposia: Child abuse and psychopathology developed during deployment in a sample of national guard soldiers [Abstract].
International Society for Traumatic Stress Studies 28th Annual Meeting

Prescott, M., Tamburrino, M., Liberzon, I., Slembarski, R., Calabrese, J. R., & Galea, S. (2009). Deployment characteristics, combat, and posttraumatic stress disorder among national guard members. [Abstract].
Society for Epidemiological Research Annual Meeting

Prescott, M., Tamburrino, M., Liberzon, I., Slembarski, R., Goldmann, E., Calabrese, J. R. et al. (2010a). Context of military and civilian traumatic events and with the risk of posttraumatic stress disorder among national guard soldiers. [Abstract].
Society for Epidemiological Research Annual Meeting

Prescott, M., Tamburrino, M., Liberzon, I., Slembarski, R., Goldmann, E., Calabrese, J. R. et al. (2010b). Social and military characteristics associated with the co-occurrence of psychopathology among national guard soldiers. [Abstract].
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Tamburrino, M., Chan, P., Prescott, M., Calabrese, J. R., Liberzon, I., Slembarski, R. et al. (2012). The ohio army national guard mental health initiative: Prevalence of DSM-IV disorders [Abstract].
American Psychiatric Association 2012 Annual Conference

Wilson, K., Tamburrino, M., Fine, T., Hogle, J., Irwin, P., Shirley, E. et al.
(October 2012). Ethics in trauma research: Participant reactions to trauma
questions in the ohio national guard. [Abstract].
National Association of Social Workers Ohio Chapter Annual Conference

List of Personnel who received pay from the research effort:
1) University Hospitals Case Medical Center (site PI: Calabrese)
   a) Joseph Calabrese, MD: all years
   b) Renee Slembarski, MBA: 2008-end
   c) Ed Shirley, PhD: 2008-end
   d) Nicole D'Arcangelo, MSW, LSW: 2010-end
   e) Toyomi Goto, MA: 2008-end
   f) Stephen Ganocy, PhD: all years
   g) Philip Chan, MS: 2008-end
   h) Alphonse Derus, BA: 2008-end
   i) Mary Beth Serrano, MA, PCC: 2008-end
   j) Abigail Williams, BA: 2010-end
   k) Elisa Fioritto, BA: 2009
   l) Eve Laidman: 2009-end
   m) Debra Matovic - 2008
   n) Carla Conroy, BA: 2007
   o) Sarah Bilali, MA: 2007-2008
   p) Tanya Smith, BA: 2007-2008
2) University of Toledo (site PI: Tamburrino)
   a) Marijo Tamburrino, MD: all years
   b) Daniel Rapport, MD: all years
   c) Thomas Fine, MA: 2008-end
   d) Kimberly Wilson, MSW: 2008-2011
   e) Deana Couch, MSW: 2011-end
   f) Xin Wang, PhD: 2007-2010
   g) Sarah Lyons, RN: 2007-2010
   h) Jenilee Hogle: 2010
   i) Rebecca Witker: 2011-end
   j) Carol Birkmanis: 2011-end
   k) Jon Elhai, PhD: 2011-end
   l) Ateka Contractor: 2011-end
   m) Teresa Biehn: 2011-end
3) University of Michigan / Columbia University (site PI: Galea)
   a) Sandro Galea, MD, DrPH: all years
   b) Katherine Hoggatt, PhD (UM only: 2007-2009)
   c) Melissa Tracy, MA (UM only: 2007-2009)
   d) Jinyao Zhang, PhD (UM only: 2009)
   e) Janie Slayden (UM only: 2009)
   f) Marta Prescott, MPH: 2007-end
   g) Emily Goldman, MPH: 2007-2010

h) Greg Cohen, MSW: 2011-end
4) Ann Arbor VA (site PI: Liberzon)
   a) Israel Liberzon, MD: all years
   b) Anthony King, PhD: all years
   c) Michael Camilleri: 2011-end
   d) Jared Fink: 2010
   e) Alex Taylor: 2010
   f) Sebastian Zoellner, PhD: 2011-end
5) Michigan State University (site PI: Reed)
   a) Phillip Reed, PhD: 2008-2011
   b) Teeradache Viangteeravat, PhD: 2011-end
   c) Joseph Bonner, MS: 2008-2011
   d) Christina Witt nee Cottrell, BA: 2008-end
   e) Troy Murray, 2008-2010
   f) Jason Paluszak, 2010
   g) Jonathan Babbage, MA: 2009-end
   h) Michael Szeidel: 2011-end

PTSD Comorbidity and Suicidal Ideation Associated With PTSD Within the Ohio Army National Guard

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Israel Liberzon, MD, PhD; Renee Slembarski, MBA; Emily Goldmann, MPH;
Edwin Shirley, PhD; Thomas Fine, MA; Toyomi Goto, MA; Kimberly Wilson, MSW;
Stephen Ganocy, PhD; Philip Chan, MS; Mary Beth Serrano, MA; James Sizemore, MDiv;
and Sandro Galea, MD, DrPH

Objective: To study the relation between posttraumatic stress disorder (PTSD) psychiatric comorbidity and suicidal ideation in a representative sample of Ohio Army National Guard soldiers.

Method: Using retrospective data collected on the telephone from a random sample of 2,616 National Guard soldiers who enrolled in a 10-year longitudinal study (baseline data collected November 2008–November 2009), we examined (1) the prevalence of other psychopathologies among those with *DSM-IV*–diagnosed PTSD compared to those without PTSD and (2) the association between PTSD comorbidity and suicidal ideation (reporting thoughts of being better off dead or hurting themselves). All analyses were carried out using logistic regression.

Results: Of guard members with PTSD in the last year, 61.7% had at least 1 other psychopathology; 20.2% had at least 2 other co-occurring conditions. The most common co-occurring psychopathology was depression. While those with PTSD overall were 5.4 (95% CI, 3.8–7.5) times more likely to report suicidality than those without PTSD, those who had at least 2 additional conditions along with PTSD were 7.5 (95% CI, 3.0–18.3) times more likely to report suicidal ideation at some point in their lifetime than those with PTSD alone.

Conclusions: Soldiers with PTSD were at increased risk for suicidality, and, among those with PTSD, those with at least 2 additional conditions were at the highest risk of suicidal ideation. Future research should address the mechanisms that contribute to multimorbidity in this population and the appropriate treatment methods for this high-risk group.

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Community-based assessments of mental illness suggest that people with a lifetime history of posttraumatic stress disorder (PTSD) compared to those without are more likely to have another psychiatric condition and that few of those with PTSD have this condition alone.[1–4] While the therapeutic challenges resulting from this degree of Axis I comorbidity indicate a need to further understand PTSD comorbidity, recent work also suggests that this co-occurrence may be associated with suicidality.[5,6]

In 2007, completed suicide was the second leading cause of death among those aged 25 to 34 years and the third most common cause among those aged 15 to 24 years in the United States.[7] In military populations, the need to better understand the link between PTSD comorbidity and suicidality, one of the greatest predictors of suicide,[8] is particularly acute given the high prevalence of PTSD comorbidity[2,9] and high rates of suicide.[10–12] However, there is no consensus on the interrelations among PTSD, PTSD comorbidity, and suicidal ideation in military populations. A recent study by Guerra and Calhoun[9] examined Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) veterans and found that while PTSD was associated with suicidality, the increase of comorbid conditions among those with PTSD was not associated with suicidality. In contrast, Jakupcak et al[13] examined treatment-seeking OIF/OEF veterans and found that the risk of suicidality was higher among those with PTSD and at least 2 other psychiatric conditions compared to those with PTSD alone.

This lack of clarity suggests a need to understand the relation between PTSD, other psychiatric conditions, and suicidal ideation. In particular, work is needed to examine this relation in populations such as National Guard soldiers. Compared to their active-duty counterparts, reserve component soldiers often experience unique stressors that may negatively affect their mental health. For example, reserve forces are often deployed separately from their unit, maintain a civilian job while deployed, and have a time-limited amount of health care insurance after deployment.[14–16] Additionally, since the first Gulf War, reserve forces have played an ever-increasing role in combat, contributing approximately 27% of combat forces in OIF/OEF as of 2007.[17]

This article uses the baseline data from a 10-year prospective cohort study of a random representative sample of the Ohio Army National Guard (OHARNG) to examine the prevalence of psychiatric comorbidity among those with PTSD and the relation between PTSD comorbidity and suicidal ideation.

METHOD

The National Guard Bureau and the institutional review boards of University Hospitals Case Medical

Center, University of Toledo, University of Michigan, Ann Arbor Veterans Administration Medical Center, Columbia University, and the Office of Human Research Protections of the US Army Medical Research and Materiel Command approved the study protocol. Verbal informed consent was obtained from all participants.

Study Population and Sampling

This study population was drawn from all serving members of the OHARNG between June 2008 and February 2009 who had addresses listed with the Guard (N = 12,225). After an alert letter was sent to all Guard members, 1,013 (8.3%) opted to not participate in the study. After eliminating those individuals who did not have a telephone number listed with the Guard (1,130; 10.1%) or incorrect numbers (3,568; 31.8%), we had 6,514 (58.1%) possible participants. Of these, 187 (2.8%) were not eligible (eg, too young or retired), 1,364 (20.9%) did not wish to participate, 31 (0.4%) were disqualified (eg, did not speak English), and 2,316 (35.6%) were not contacted before the cohort closed. Official enrollment (N = 2,616) and consent to participate in the study began in November 2008 and ended November 2009. Participants were compensated for their time.

Telephone Interview and Psychopathology Assessments

The computer-assisted telephone interview was field tested in November 2008. All assessments of psychopathology included questions to assess *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition (*DSM-IV*) criteria. Additionally, questions on timing were included to assess whether or not the symptoms were present in the past 30 days, present in the past year, or ever present in the person's lifetime.

To assess self-perceived social support as well as collect information on traumatic events experienced during deployment, we used an adapted form of the Deployment Risk and Resilience Inventory.[18] We used a modified form of the Life Events Checklist from the Clinician-Administered PTSD Scale[19,20] to collect the frequency of traumatic events throughout their lifetime. The scale was modified to include additional questions used in other population-based studies to allow for comparisons.[21]

To assess PTSD, we used the PTSD Checklist-Civilian Version.[22] PTSD symptoms were asked in relation to 2 traumas: the self-identified "worst" traumatic event from outside the person's most recent deployment and the self-identified

"worst" traumatic event experienced during their most recent deployment.[19,20,23] To be diagnosed with PTSD, a person had to experience criteria A1 and A2 (experiencing a traumatic event and intense fear, hopelessness, and horror due to a trauma) as well as meet criterion B (at least 1 symptom of reexperiencing the trauma), criterion C (at least 3 symptoms of avoidance of the trauma), criterion D (at least 2 symptoms of hyperarousal), criterion E (duration of 1 month), and criterion F (significant impairment).[24] To have PTSD, a person had to meet all *DSM-IV* criteria related to a specific traumatic event and then have PTSD either from the traumatic event that occurred during their most recent deployment or from an event outside their most recent deployment.

We used the Patient Health Questionnaire-9 (PHQ-9)[25] to assess any depressive disorder. To be diagnosed with depressive disorder (including major depressive disorder [MDD]), a person had to have at least 2 or more co-occurring symptoms on the PHQ-9, with at least 1 being depressed mood or anhedonia.[25,26]

To assess generalized anxiety disorder (GAD), we used the GAD-7.[27] To be diagnosed with GAD, a person had to have co-occurring symptoms with a score greater than or equal to 10, have symptoms for at least 6 months, and report functional impairment.[27]

The Mini-International Neuropsychiatric Interview[28] was used to assess alcohol dependence and alcohol abuse. A lifetime history of alcohol abuse occurred if the individual met criterion A (at least 1 symptom of maladaptive pattern of substance use leading to impairment or distress) and criterion B (never met the classification for alcohol dependence).[28] A lifetime history of alcohol dependence was present if the individual met at least 3 symptoms of maladaptive pattern of substance abuse leading to impairment or distress.[28]

To have suicidal ideation in their lifetime, individuals had to report feeling that they had ever had thoughts of being better off dead or wanting to hurt themselves as determined from the PHQ-9.[25,26]

Clinical Interview

All psychopathology assessments were tested against a clinical reappraisal undertaken on a subsample of the study population (N = 500), and we found the assessments reliable and valid in this population. Participants recruited for this subsample were interviewed again using the full Structured Clinical Interview for *DSM-IV* Axis I Disorders and were compensated for their time. In our clinical reappraisal, we found the assessments had high specificity (ranging from 0.80 for alcohol abuse and 0.98 for generalized anxiety disorder) and were unlikely to classify individuals with a condition when they did not actually have the condition. The reliability estimates were similarly as high, with the Cronbach α ranging from 0.57 for alcohol abuse to 0.95 for PTSD from the most recent deployment (M.T., unpublished data, March 2011).

Statistical Analyses

We first compared the distribution of characteristics (ie, gender, age, education) of our sample to the OHARNG

Table 1. Characteristics of the Ohio Army National Guard Study Participants[a]

Characteristic	Total (N = 2,616) n	%	Ohio National Guard 2008 Profile (N = 10,778) n	%	P Value
Gender					.16
Male	2,228	85.2	9,293	86.2	
Female	388	14.8	1,485	13.8	
Age					<.01
17–24 y	878	33.6	4,043	37.5	
25–34 y	848	32.5	3,746	34.8	
35–44 y	634	24.3	2,143	19.9	
45+ y	250	9.6	846	7.8	
Race					<.01
White	2,295	87.8	9,512	88.3	
Black	195	7.5	1,083	10.0	
Other	123	4.7	183	1.7	
Income					
≤ $60,000	1,498	59.1	…	…	
> $60,000	1,038	40.9	…	…	
Education					
High school graduate/GED or less	727	27.8	…	…	
Some college or technical training	1,234	47.2	…	…	
College/graduate degree	655	25.0	…	…	
Marital status					<.01
Married	1,227	47.0	4,154	38.5	
Divorced/separated/widowed	252	9.6	657	6.1	
Never married	1,134	43.4	5,967	55.4	
Rank					<.01
Officer	342	13.1	1,028	9.5	
Enlisted, cadets, and civilian employees	2,273	86.9	9,750	90.5	
Most recent deployment location					
Never deployed	939	36.1	…	…	
Nonconflict area	872	33.5	…	…	
Conflict area	793	30.5	…	…	
No. of lifetime deployments					
0–1	1,756	67.4	…	…	
2–3	682	26.2	…	…	
4+	169	6.5	…	…	
Total no. of all traumatic events experienced					
0	141	5.4	…	…	
1–5	887	33.9	…	…	
6–11	831	31.8	…	…	
12+	757	28.9	…	…	

[a]Some percentages will not add up to the total due to missing values. All tests were conducted using a 2-tailed χ² test.
Abbreviation: GED = general equivalency diploma.

Table 2. Prevalence of Disorders in the Ohio Army National Guard Sample[a]

Condition	Past Month n	%	Past Year n	%	Ever in Lifetime n	%
PTSD	136	5.2	188	7.2	249	9.5
Depressive disorder	167	6.4	365	14.0	560	21.4
Generalized anxiety disorder	45	1.7	53	2.0	75	2.9
Alcohol abuse	68	2.6	139	5.3	628	24.0
Alcohol dependence	91	3.5	183	7.0	615	23.5
No disorder	2,224	85.0	1,932	73.9	1,099	42.0
At least 1 condition	304	11.6	496	19.0	1,060	40.5
At least 2 conditions	88	3.4	188	7.2	457	17.5

[a]One hundred forty-one people (5.4%) never had a trauma and were coded as never having PTSD for these statistics; 14 people (0.5%) refused or did not answer the PTSD symptoms and were coded as missing. One hundred eighteen people (4.5%) reported never having drunk alcohol in their life and therefore were coded as not having the condition. The combinations of conditions include those who never had a trauma and therefore were not at risk for PTSD.
Abbreviation: PTSD = posttraumatic stress disorder.

To answer our main question, we used logistic regression to examine the relation between comorbid presentation of PTSD and suicidal ideation. We compared a lifetime history of suicidal ideation among those with and without PTSD. Then, separately among those with PTSD, we examined the association between comorbid PTSD in the past year and suicidal ideation. The mode of survey administration resulted in the lack of collection on current alcohol use for 6% of participants. To determine how this may have affected our results, we ran sensitivity analyses assuming that these individuals all had an alcohol use disorder, that none did, or that a random proportion had an alcohol use disorder.

RESULTS

The characteristics of the baseline survey are described in Table 1. Similar to the OHARNG, our sample was predominantly male (85.2%) and white (87.7%). Our sample is slightly older than the OHARNG, and approximately half are married. Sixty-four percent had deployment experience, with the majority having between 1 and 3 deployments. The past month, past year, and lifetime prevalence of mental disorders in the total baseline sample (N = 2,616) is described in Table 2. The most common mental disorder in the past month and past year, respectively, was depression (6.4%, 14.0%), followed by PTSD (5.2%, 7.2%). The most common condition ever reported was alcohol abuse (24.0%) relative to alcohol dependence (23.5%), depression (21.4%), PTSD (9.5%), and GAD (2.9%). In the past month, past year, and lifetime, respectively, 85.0%, 73.9%, and 42.0% of the individuals had none of these disorders.

The 12-month psychiatric comorbidity in soldiers with and without PTSD and then separately for men and women is described in Table 3. In soldiers with PTSD, the most prevalent condition was depression (48.9%), followed by alcohol dependence (17.0%) and GAD (16.0%). Compared to those without PTSD, GAD was 21.6 times more likely to occur in those with PTSD, and depression was 7.6 times more likely. Whereas alcohol dependence was 3.1 times more

using 2-tailed χ² tests. We also described the prevalence of individual psychopathologies (PTSD, any depressive disorder, GAD, alcohol abuse, and alcohol dependence) and the prevalence of no conditions, at least 1 condition, and the co-occurrence of any of the conditions in 3 time frames: in the past month, in the past year, and ever in the person's lifetime.

To answer our first question, we used logistic regressions to examine the association between PTSD and psychiatric comorbidity. We compared the prevalence of other conditions within the past year (co-occurring depression, GAD, alcohol abuse, alcohol dependence, no other diagnosis, 1 other diagnosis, 2 other diagnoses, then 3 other diagnoses) among those with PTSD and without PTSD. We then examined these comparisons separately for men and women.[29]

Table 3. Distribution of Mental Health Conditions Comparing Individuals With PTSD Within the Past Year to Those Who Did Not Have PTSD Within the Past Year

	PTSD (n = 188)		No PTSD (n = 2,414)		Odds Ratio	Confidence Interval	
	n	%	n	%		Upper	Lower
Overall (N = 2,602)							
Conditions							
Depressive disorder	92	48.9	269	11.1	7.6	5.6	10.4
Generalized anxiety disorder	30	16.0	21	0.9	21.6	12.1	38.7
Alcohol abuse	14	7.5	125	5.2	1.5	0.8	2.6
Alcohol dependence	32	17.0	149	6.2	3.1	2.1	4.7
Co-occurrence of other conditions							
No other disorder	72	38.3	1,922	79.6	0.2	0.1	0.2
One other condition	78	41.5	423	17.5	3.3	2.5	4.5
Two or more other conditions	38	20.2	69	2.9	8.6	5.61	13.2
Men (n = 2,215)	n = 145		n = 2,070				
Conditions	n	%	n	%			
Depressive disorder	67	46.2	216	10.4	7.4	5.2	10.5
Generalized anxiety disorder	27	18.6	16	0.8	29.4	15.4	56.0
Alcohol abuse	12	8.3	114	5.5	1.5	0.8	2.9
Alcohol dependence	29	20.0	139	6.7	3.5	2.2	5.4
Co-occurrence of other conditions							
No other disorder	56	38.6	1,647	79.6	0.2	0.1	0.2
One other condition	55	37.9	364	17.6	2.9	2.0	4.1
Two or more other conditions	34	23.5	59	2.9	10.4	6.6	16.6
Women (n = 387)	n = 43		n = 344				
Conditions	n	%	n	%			
Depressive disorder	25	58.1	53	15.4	7.6	3.9	14.9
Generalized anxiety disorder	3	7.0	5	1.5	5.1	1.2	22.1
Alcohol abuse	2	4.7	11	3.2	1.5	0.3	6.9
Alcohol dependence	3	7.0	10	2.9	2.5	0.7	9.5
Co-occurrence of other conditions							
No other disorder	16	37.2	275	79.9	0.1	0.1	0.3
One other condition	23	53.5	59	17.2	5.6	2.9	10.8
Two or more other conditions	4	9.3	10	2.9	3.5	1.03	11.4

Abbreviation: PTSD = posttraumatic stress disorder.

Table 4. Lifetime History of Suicidal Ideation Among Those With Current PTSD and Those With PTSD Accompanied by Psychiatric Comorbidity

	History of Suicidal Ideation		Odds Ratio	Confidence Interval	
	n	%		Lower	Upper
Association with current PTSD					
No PTSD (n = 2,410)	200	8.3	Reference	...	...
Current case of PTSD (n = 187)	61	32.6	5.4	3.8	7.5
Association with PTSD accompanied by comorbidity					
Current PTSD only (n = 72)	13	18.1	Reference	...	...
Current PTSD + 1 (n = 78)	25	32.1	2.1	1.0	4.6
Current PTSD + 2 or more (n = 37)	23	62.2	7.5	3.0	18.3

Abbreviation: PTSD = posttraumatic stress disorder.

likely, alcohol abuse was reported to the same extent in those with and without current PTSD. Those with PTSD were very unlikely to have no other lifetime disorder. When we stratified by gender, results were largely comparable, but we did find that while male soldiers with PTSD were 29.4 times more likely to have GAD compared to males who did not have PTSD, female soldiers were only 5.1 times more likely.

Table 4 and Figure 1 display the association between a lifetime history of suicidal ideation and PTSD as well as comorbid PTSD. Those with PTSD (as compared to those without) were 5.4 times more likely to have a history of suicidal ideation. Soldiers with PTSD and at least 2 comorbid conditions had 7.5 times greater odds of reporting suicidal ideation compared to those with PTSD only.
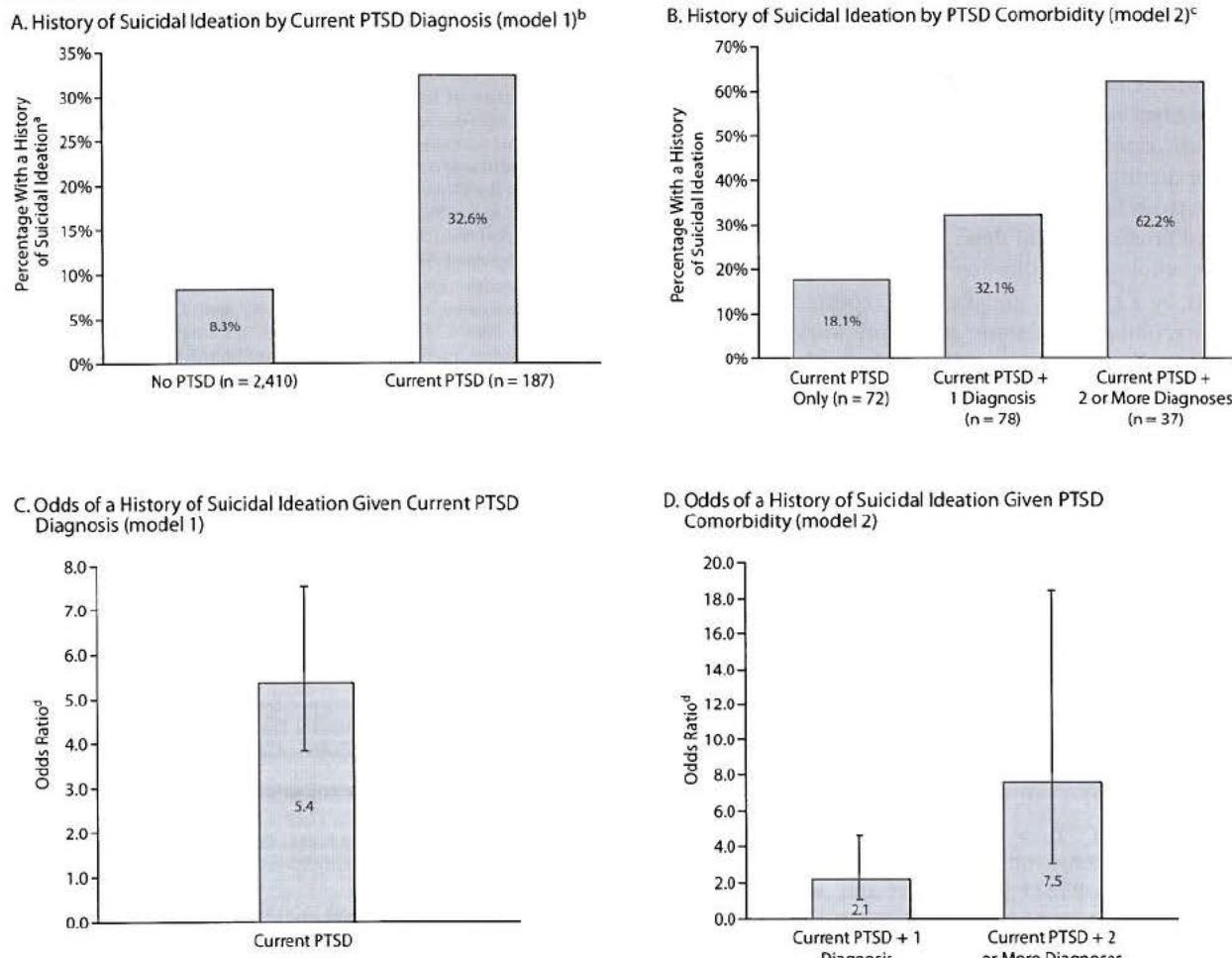
There were no statistically significant or meaningful differences in the associations reported here in the sensitivity analyses.

DISCUSSION

In a representative sample of OHARNG soldiers, we found that those with PTSD were more likely to report suicidal ideation. Among those with PTSD, comorbidity with more than 1 disorder was associated with a higher risk for suicidal ideation. The general association between PTSD and suicidal ideation in National Guard soldiers adds to the growing evidence for this association in military populations.[9,13,30] With respect to PTSD comorbidity, we found a specific association: among those with PTSD, those with 2 or more comorbid disorders were 7 times more likely to have ever reported suicidal ideation as compared to those with PTSD only. These results were consistent with work by Jakupcak et al,[13] who found that compared to veterans with PTSD alone, those with 2 or more additional conditions were more likely to report suicidal ideation.

Considering the prevalence of PTSD multimorbidity, the relation between PTSD with multiple disorders and suicidal ideation has particular clinical import. Within the past year, 61.7% of soldiers with PTSD had at least 1 other condition and 20.2% had at least 2 other conditions, a level comparable to other military populations.[2,31] In comparison, 2 or more conditions were present in only 2.9% of those without PTSD. The prevalence of multiple conditions among those with PTSD and the increased association of this group with suicidal ideation highlight a singular subgroup of clinical and therapeutic concern.

We found that the most common co-occurring condition with PTSD was depression, at 48.9% (46.2% among men and 58.1% among women). While we used a definition of depression that was not limited to MDD alone, several studies that examined MDD found a similarly high prevalence among those with PTSD.[1,32,33] In military populations, 56% of Israeli soldiers seeking PTSD treatment recently had major depressive disorder,[32] and 52% of a population-based sample of Australian Korean War veterans who had PTSD recently had MDD.[33] The increased risk of depression among those with PTSD (7.6-fold over those without PTSD) was comparable to 2 population-based military studies including the Millennium Cohort (4-fold increase in men and 3-fold increase in women for MDD) and the National Vietnam Veterans Readjustment Survey (10-fold increase for MDE).[2,34] The implications of this overlap have been reported in other studies, which found

Figure 1. Individuals With PTSD as Well as Those With PTSD Multimorbidity Were More Likely to Have a History of Suicidal Ideation[a]

A. History of Suicidal Ideation by Current PTSD Diagnosis (model 1)[b]

B. History of Suicidal Ideation by PTSD Comorbidity (model 2)[c]

C. Odds of a History of Suicidal Ideation Given Current PTSD Diagnosis (model 1)

D. Odds of a History of Suicidal Ideation Given PTSD Comorbidity (model 2)

[a]Lifetime prevalence.
[b]Model 1 result: compared to 200 of those without PTSD (n = 2,410), 61 of those with PTSD (n = 187) had a history of suicidal ideation.
[c]Model 2 result: compared to the 13 of those with only PTSD (n = 72), 25 of those with PTSD and 1 more condition (n = 78) and 23 of those with PTSD and 2 or more other conditions (n = 37) had a history of suicidal ideation.
[d]Logistic regression. Bar represents confidence interval.
Abbreviation: PTSD = posttraumatic stress disorder.

higher severity of PTSD symptoms, poor self-reported quality of life, and increased functional impairment and suicidal ideation among those with PTSD and depression compared to those with either condition alone.[3,33,34] Future research should focus on persons with co-occurring mood-anxiety disorders as a particularly vulnerable group.

In our sample, the second most prevalent condition among those with PTSD was alcohol dependence. Often reported along with alcohol abuse as the most common co-occurring condition with PTSD,[35] alcohol dependence had a high prevalence overall among those with PTSD (17.0%). This was primarily a concern among men with PTSD (20.0%). This prevalence of alcohol dependence was lower than that reported in the National Comorbidity Survey (men 52% and women 30%) but comparable to other military studies. Kulka et al[2] reported 22% of current alcohol abuse or dependence cases among those with PTSD in the National

Vietnam Veterans Readjustment Survey, and 39% of those with PTSD had some form of alcohol disorder (abuse or dependence) in the Vietnam Experiences Study.[3] We found that, compared to those without PTSD, those with PTSD were 3.1 times more likely to have had alcohol dependence within the past year. In contrast to alcohol dependence, we found no increase in the prevalence of alcohol abuse among those with PTSD compared to the rest of the sample—alcohol abuse was reported to the same extent regardless of mental health or gender. Further research is necessary to examine the association between alcohol dependence and PTSD, as it may be a result of alcohol dependence preceding PTSD[3] but also may be a result of self-medication to deal with the symptoms of PTSD.[3,35,36] Regardless, the therapeutic concerns for this overlap are similar to those of other conditions and include diagnostic concerns[3] as well as treatment implications.[35-37]

Clinicians and family members should be alert to the clinical relevance of presentations of PTSD complicated by major depressive episodes and/or alcohol dependence. These 2 types of comorbidity appear to increase the risk of suicidality more than 7-fold. It may be useful for clinicians to meet with family members at the time of the initial diagnostic assessment to inquire about these specific types of co-occurring illnesses.

This study has several limitations. We utilized retrospective and cross-sectional data. While we cannot tell if the psychopathologies predisposed suicidal ideation, the meta-analysis by Krysinska and Lester[30] reported evidence of both directional associations, and future work will examine the longitudinal aspects of PTSD and suicidal ideation. In addition, these psychopathologies are self-reported, which may lead to misdiagnosis given the retrospective and non-clinical nature of the data. Similar to the above limitation, longitudinal clinical data should be examined to see if these associations are robust. Regardless, in our validation testing using the clinical subsample, we found that the specificity of our assessment tools was high, and therefore those who were classified as probable cases were likely to have the condition in question. Moreover, we found no evidence of specificity differences by gender (except for alcohol abuse), race, or age for all mental health diagnoses (data available upon request) that argues that any misclassification would likely be non-differential, and therefore any associations are likely a conservative estimate. Due to the time limitation of the telephone survey, we were unable to collect more mental health conditions, and future work needs to examine the relation between PTSD comorbidity and suicidal ideation considering all Axis I and Axis II conditions. Given the robustness of sensitivity analysis, it is unlikely that the mode of survey administration had a substantial impact on absolute prevalences. However, it is possible that relative ranking of disorders with similar prevalences would be altered under different conditions.

The strengths of this work are due to the strong qualities of the OHARNG Mental Health Initiative. The study is a large, population-based sample of National Guard soldiers representative of OHARNG. Therefore, the conclusions may be generalizable to OHARNG and the Army National Guard.

CONCLUSION

In the OHARNG Mental Health Initiative, the majority of current persons with PTSD also had at least 1 other psychiatric condition; 20% had multiple conditions. PTSD multimorbidity was strongly associated with a history of suicidal ideation. Future work should examine all Axis I and Axis II conditions in relation to PTSD comorbidity and suicide risk. In addition, work should investigate the mechanisms linking PTSD with multiple conditions to suicidal ideation. Clinical implications include a need to monitor this high-risk group for indications of suicidal thoughts and examine effective methods of treatment for persons with PTSD multimorbidity.

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Potentially Modifiable Pre-, Peri-, and Postdeployment Characteristics Associated With Deployment-Related Posttraumatic Stress Disorder Among Ohio Army National Guard Soldiers

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PURPOSE: To evaluate potentially modifiable deployment characteristics—predeployment preparedness, unit support during deployment, and postdeployment support—that may be associated with deployment-related posttraumatic stress disorder (PTSD).

METHODS: We recruited a sample of 2616 Ohio Army National Guard (OHARNG) soldiers and conducted structured interviews to assess traumatic event exposure and PTSD related to the soldiers' most recent deployment, consistent with DSM-IV criteria. We assessed preparedness, unit support, and postdeployment support by using multimeasure scales adapted from the Deployment Risk and Resilience Survey.

RESULTS: The prevalence of deployment-related PTSD was 9.6%. In adjusted logistic models, high levels of all three deployment characteristics (compared with low) were independently associated with lower odds of PTSD. When we evaluated the influence of combinations of deployment characteristics on the development of PTSD, we found that postdeployment support was an essential factor in the prevention of PTSD.

CONCLUSIONS: Results show that factors throughout the life course of deployment—in particular, postdeployment support—may influence the development of PTSD. These results suggest that the development of suitable postdeployment support opportunities may be centrally important in mitigating the psychological consequences of war.

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KEY WORDS: Military Personnel, Post-Traumatic Stress Disorders, War.

INTRODUCTION

The authors of several studies have documented the prevalence of psychopathology after combat. In a study of veterans from the first Gulf War (1990−1991), Kang et al. (1) reported that the prevalence of posttraumatic stress disorder (PTSD) was 10.1% approximately 10 years after the war. Hoge et al. (2) examined soldiers upon returning from deployment and found prevalence estimates of 12.9% and 6.2% among U.S. Army soldiers in Iraq (Operation Iraqi Freedom, [OIF]) and Afghanistan (Operation Enduring Freedom [OEF]), respectively, and 12.2% among Marine Corps soldiers who served in OIF. The Millennium Cohort Study, a prospective study that assesses mental health in current and former members of the U.S. military, reported at baseline that 2.4% of respondents had the symptoms of PTSD in the past month (3).

Although there are fewer such studies, some investigators have also estimated the burden of PTSD among National Guard and Reserve soldiers, ranging from 2.0% in Gulf War veterans (4, 5) to 12.7% in OIF veterans (6). These soldiers have historically contributed only part-time to the military and have principally participated in mostly domestic incidents. However, more recently they have increasingly been deployed to war zones overseas. As of 2008, Guard and Reserve forces constituted approximately

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Selected Abbreviations and Acronyms

PTSD = posttraumatic stress disorder
OIF/OEF = Operation Iraqi Freedom/Operation Enduring Freedom
OHARNG = Ohio Army National Guard
DRRI = Deployment Risk and Resilience Inventory
DSM-IV = Diagnostic and Statistical Manual of Mental Disorders
OR = odds ratio
CI = confidence interval

11% of current combat forces in OIF and 21% in OEF (7). Understanding what factors influence PTSD development among Guard and Reserve forces may shed light on postdeployment psychopathology in this population.

Risk factors for PTSD can be divided into three groups on the basis of their temporal relationship with the traumatic event (i.e., characteristics from before, during, and after the event) (8). In studies that use data from various military populations, e.g., veterans of the Vietnam War (9), the first Gulf War (10), OIF and OEF (11, 12), as well as soldiers and peacekeepers in other combat locations (13), authors have examined the relationship between these types of variables and PTSD after deployment. They have found associations between PTSD and predeployment risk factors, such as socioeconomic status, history of early trauma, antisocial behavior during childhood, friendships and family environment in childhood, age at entry to Vietnam, and exposure to predeployment stressors (10, 14 16). Other studies report relations between PTSD and factors during deployment, such as traditional combat experience, difficult living/working environment, concerns about family at home, unit support, experience with atrocities or abusive violence, and perceived life threat (10, 13, 16 18). Postdeployment factors such as additional stressful life events, hardiness, and social support also are influential in the development of PTSD, with perceived functional social support acting as a particularly strong predictor of the disorder (13, 15, 16, 19 21).

Although some of the risk factors identified in these studies are inextricable from the experience of war, other factors may well be modifiable and can therefore point to potential interventions that may mitigate the psychological consequences of war. In this study we consider modifiable factors pre-, peri-, and post-deployment that may influence the risk of PTSD by using baseline data from a 10-year prospective study of a current Army National Guard population. We approach the study from a life-course perspective, considering both the independent and the interactive contribution of these factors (22). Although we evaluate the independent relations between each deployment factor and deployment-related PTSD, we are particularly interested in how these factors together influence risk of PTSD. We hope that through this approach we might (i) identify potential areas of intervention that can be modified throughout the course of deployment to mitigate the consequences of deployment experience or (ii) identify one modifiable deployment characteristic whose improvement may have the greatest benefit to soldiers' postdeployment psychological well-being.

METHODS

The source population for the study was Ohio Army National Guard (OHARNG) soldiers who were serving between June 2008 and February 2009. We invited all participants through a two-stage process between November 2008 and November 2009. First, we notified all OHARNG soldiers through an opt-out card (N 12,225). Second, among those who did not return an opt-out card (N 10,082), we called all remaining soldiers who had a working phone number on file with the guard (n 6514; 64.6%). Of these soldiers, 2616 male and female soldiers ultimately took part in the study (43.2% fraction who consented to a survey [2616 + 187] among all correct numbers minus the ineligible [6514 31]). This sample excluded those who did not want to participate (n 1364), those never reached (n 2316), retired (n 187), or ineligible (n 31). Additional work on the baseline population of the OHARNG MHI found that the sample was representative of the Ohio National Guard overall (data available upon request). For this work, our study population was the members of the OHARNG MHI who had ever been deployed (n 1668, 63.8% of the parent study). Of those deployed, 41.9% of members who had ever been deployed had most recently been deployed to OIF, whereas 4.7% had been most recently deployed to OEF.

We conducted 60-minute structured telephone interviews to assess lifetime traumatic event experience (in civilian life and during most recent deployment), symptoms of PTSD, depression, and generalized anxiety disorder, social support, general health history, overall military and deployment experience, substance use and other behaviors, and demographic information.

We assessed pre-, peri-, and post-deployment domains associated with respondents' most recent deployments specifically, predeployment military preparedness, unit support during deployment, and post-deployment support by using validated instruments from the Deployment Risk and Resilience Inventory (DRRI). Each instrument comprised several items asking whether the participant had that particular experience; scores per item ranged from 1 (strongly disagree) to 5 (strongly agree). We summed item scores to create a total score for each domain. Scores were calculated for all participants, even if not all questions were answered; the unanswered questions were treated as having a score of 0, a neutral response. All three domains showed good internal consistency in our study population

(standardized Cronbach's coefficient alpha 0.7, 0.8, 0.7, respectively). We created dichotomous variables for these factors (e.g., high vs. low preparedness) on the basis of their median scores. Scores greater than 21, 29, and 24 indicated high preparedness, high unit support, and high postdeployment support, respectively. We then created eight dummy variables to represent combinations of pre-, peri-, and post-deployment experiences (e.g., high preparedness, low unit support, high postdeployment support).

We assessed traumatic event experience during the most recent deployment by using a list of 20 events from the DRRI, as well as one item from an additional list of 19 other events that asks about combat experience, used by Breslau et al. (23) We used the PTSD Checklist, a 17-symptom self-report measure based on Diagnostic and Statistical Manual of Mental Disorders, Edition 4 (DSM-IV) criteria B, C, and D (24), to evaluate symptoms of re-experiencing, avoidance/numbing, and increased arousal related to a deployment traumatic event (25). If a participant experienced more than one event during deployment, we asked PTSD symptom questions based on the event reported as the "worst." Participants indicated how much each symptom bothered them from 1 (not at all) to 5 (extremely). Scores can range from 17 to 85 (26).

Additional questions were used to assess DSM-IV criteria A2 (feelings of intense fear, helplessness, or horror in response to the event), E (at least 1-month duration of symptoms), and F (clinically significant distress or disability attributable to symptoms) (25). Participants had to meet all six DSM-IV criteria to be considered a PTSD case. We conducted clinical, in-person interviews among a random sample of telephone survey participants (n 500) to validate the PTSD Checklist by using the Clinician-Administered PTSD Scale (27, 28). Clinicians were blinded to responses from the telephone survey.

We used logistic regression analysis to examine the relation between the deployment-related characteristics and their combinations and symptoms of deployment-related PTSD among those who had experienced at least one deployment-related traumatic event during their most recent deployment. To address the possibility that our DRRI measures differed by the number of deployments experienced, we compared the distribution of the high DRRI measure across deployments (1, 2, or 3 or more). Regressions were adjusted for military experience (pay grade, number of deployments, location of most recent deployment in a conflict area or nonconflict area, number of deployment-related traumatic events experienced during most recent deployment) and other sociodemographic characteristics (age, gender, race, household income, educational attainment, and marital status, all self-reported). We selected potential confounders based on the definition of a confounder: there existed an association between the

TABLE 1. Characteristics of the OHARNG study participants

Characteristics	Been deployed (n = 1668)	
	n	%
Gender		
Male	1498	89.8
Female	170	10.2
Age, yr		
17 24	297	17.8
25 34	656	39.3
35 44	524	31.4
45+	189	11.3
Race		
White	1477	88.5
Black	114	6.8
Other	74	4.4
Income		
≤$60,000	885	53.1
$60,001+	748	44.8
Education		
High school graduate/GED or less	375	22.5
Some college or technical training	824	49.4
College/graduate degree	469	28.1
Marital status		
Married	954	57.2
Divorced/separated/widowed	189	11.3
Never married	522	31.3
Rank		
Officer	256	15.3
Enlisted, cadets, and civilian employees	1411	84.6
Most recent deployment location		
Never deployed	0	0.0
Nonconflict area	872	52.3
Conflict area	793	47.5
Number of lifetime deployments		
0	0	0.0
1	817	49.0
2 3	682	40.9
4+	165	9.9
Total number of deployment-related traumatic events experienced		
0	374	22.4
1 5	588	35.3
6 11	337	20.2
12+	369	22.1

OHARNG = Ohio Army National Guard.
Note: These are the percentage breakdown of demographics and military characteristics among those with deployment experience. Some percentages do not add up to 100 because of missing values.

selected characteristics and our exposure as well as our outcomes of interest (data available upon request). We used SAS 9.2 (SAS Institute Inc., Cary, NC) for all analyses.

RESULTS

Table 1 shows descriptive characteristics of those soldiers who had been deployed (our study population n 1668). The majority of participants were men (89.8%), with more participants reporting being white than another race

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TABLE 2. Characteristics related to most recent deployment among those who have been deployed (n = 1668)

	Median	Range	Alpha*
Training and deployment preparation	21.0	4 25	0.7
I had all the supplies and equipment needed to get my job done	4.0		
The equipment I was given functioned the way it was supposed to	5.0		
I received adequate training on how to use my equipment	5.0		
I was accurately informed about what to expect from the enemy	4.0		
I was accurately informed of what daily life would be like during my deployment	4.0		
Unit support	29.0	7 35	0.8
I felt a sense of camaraderie between myself and other soldiers in my unit	5.0		
Most people in my unit were trustworthy	4.0		
I could go to most people in my unit for help when I had a personal problem	4.0		
My commanding officers were interested in what I thought and how I felt about things	4.0		
I was impressed by the quality of leadership in my unit	4.0		
My superiors made a real attempt to treat me as a person	4.0		
I felt like my efforts really counted to the military	4.0		
Postdeployment support	26.0	1 30	0.7
The reception I received when I returned from my deployment made me feel appreciated for my efforts	5.0		
The American people made me feel at home when I returned	5.0		
When I returned, people made me feel proud to have served my country in the Armed Forces	5.0		
People at home just don't understand what I have been through while in the Armed Forces[†]	2.0		
There are people to whom I can talk about my deployment experiences	5.0		
The people I work with respect the fact that I am a veteran	5.0		

These are the characteristics (mean, median, and Chronbach's alpha) reported from the Deployment Risk and Resilience Inventory (DRRI). Each question was asked on a scale from 1–5, with 1 being strongly disagree and 5 being strongly agree.
*Cronbach's coefficient alpha (standardized).
[†]Recoded, reverse order.

(88.5% vs 11.2%), and almost half of the sample was married (57.2%). The majority (77.6%) experienced at least one traumatic event during their most recent deployment. When compared with the parent study population, the deployed population was significantly older than the total population; more were male, married, officers, had greater income and educational attainment, and greater traumatic event experience (all $p < .01$). The majority of the sample had been deployed within 3 years of the survey (61.8%). Data from the validation analyses (not shown) yielded excellent internal consistency (0.95). In addition, we found that the specificity was extremely high (0.97) but the sensitivity was weak (0.35).

Table 2 shows the pre-, peri-, and post-deployment characteristics included in this study training and deployment preparedness, unit support, and postdeployment support, respectively as they relate to the participant's most recent deployment among those soldiers who have been deployed. As a domain, preparedness had the lowest median score (21.0) and unit support had the highest (29.0). Among the individual items, feeling that people at home did not understand what the participant had been through while in the Armed Forces had the lowest median score (2.0). Score ranges by domain show that participants failed to answer a greater number of questions in the postdeployment support section than in the other sections. We did not find that the frequency of those with high levels of training and deployment preparedness, unit support, or postdeployment support differed depending on the number of deployments the soldiers experienced.

Table 3 reports the distribution of the eight deployment characteristic combinations among those who have been deployed. The largest proportion of the sample reported high levels for all three domains (25.2%). The high preparedness, high unit support, and low post-deployment support combination was reported by the smallest proportion of soldiers (3.2%). The prevalence of deployment-related PTSD (given exposure to a deployment-related traumatic event) was highest among those who reported low for all three domains (22.4%) and lowest among those

TABLE 3. Distribution of pre-, peri-, and postdeployment characteristic combinations and PTSD among those who have been deployed (n = 1668)

Combination	Preparedness	Unit support	Postdeployment support	n	%	PTSD %*
1	High	High	High	421	25.2	4.7
2	High	High	Low	53	3.2	11.9
3	High	Low	High	189	11.3	4.2
4	High	Low	Low	65	3.9	16.4
5	Low	High	High	259	15.5	6.2
6	Low	Low	High	377	22.6	7.6
7	Low	High	Low	55	3.3	20.0
8	Low	Low	Low	249	14.9	22.4
Overall						9.6

PTSD = posttraumatic stress disorder.
*Among those who experienced a traumatic event during their most recent deployment (n = 1294).
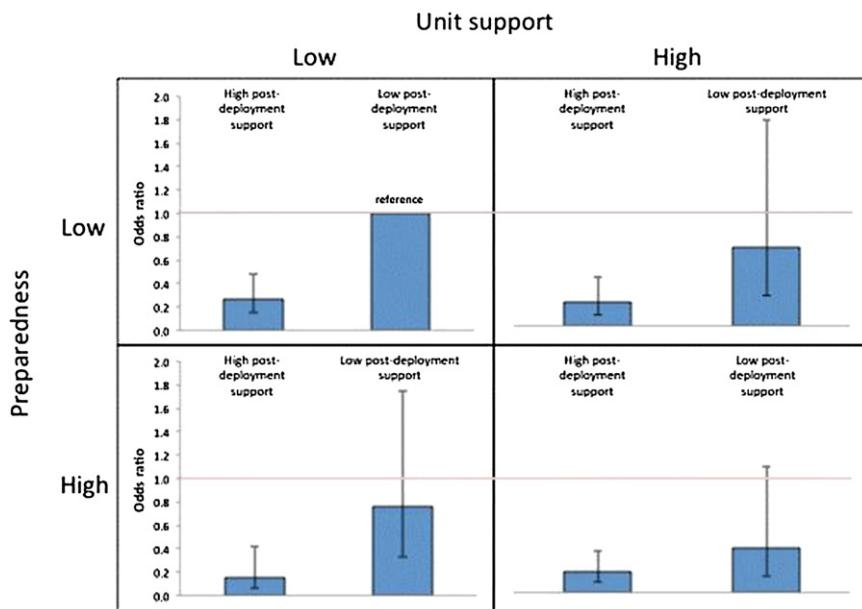
FIGURE 1. Association between pre-, peri-, and postdeployment characteristics and deployment-related PTSD. Reporting the lowest of all three deployment characteristics is the reference category for all ORs. These are the results from the multivariable regression, which are adjusted for gender, age, race, income, educational attainment, marital status, rank, most recent deployment location, total number of deployment-related traumatic events and number of deployments. Significance at $p < .05$.

who reported high preparedness, low unit support, and high post-deployment support (4.2%). Overall, the prevalence of PTSD from a deployment-related event was 9.6%.

High preparedness, high unit support, and high post-deployment support (vs low levels) were all associated with lower odds of PTSD in separate multivariable models (preparedness: odds ratio [OR], 0.6; 95% confidence interval [CI], 0.4–0.9; unit support: OR, 0.5; 95% CI, 0.3–0.8; post-deployment support: OR, 0.3; 95% CI, 0.2–0.4). Figure 1 shows results from multivariable regression analysis that modeled deployment characteristic combinations as dummy variable predictors of PTSD, adjusted for gender, age, race, income, educational attainment, marital status, rank (officer vs enlisted, cadets, and civilian employees), most recent deployment location (to nonconflict area vs conflict area), and total number of deployments-related traumatic events experienced (one vs two or more). Four of the characteristic combinations — all of those that included *high* postdeployment support — had significantly lower odds of PTSD with the low preparedness, low unit support, and low postdeployment support combination as the reference group.

Specifically, soldiers reporting (i) low preparedness, low unit support, and high post-deployment support; (ii) low preparedness, high unit support, and high post-deployment support; (iii) high preparedness, low unit support, and high post-deployment support; and (iv) high levels of all three domains had significantly lower odds of developing PTSD than those who reported low levels of all three domains (OR, 0.3; 95% CI, 0.1–0.5; OR, 0.2, 95% CI,

0.1–0.4; OR, 0.2, 95% CI, 0.1–0.4; and OR, 0.2, 95% CI, 0.1–0.4; respectively). The odds of PTSD were not significantly lower for any combination that included low postdeployment support, compared with the reference group.

DISCUSSION

Characteristics at various stages of deployment may influence the likelihood of developing PTSD from a deployment-related traumatic event in this population. We found that reporting high levels (compared with low levels) of the three pre-, peri-, and postdeployment factors preparedness, unit support, and post-deployment support were all independently associated with lower odds of deployment-related PTSD, consistent with findings from previous studies (13, 18, 19, 29 31). Soldiers who report high training and deployment preparedness, i.e., knowing what to expect, having adequate supplies and training, may be more psychologically prepared for the potentially traumatic events they may experience during combat and thus may be more able to appraise the level of threat related to these experiences.

In a recent study, Renshaw (30) found that soldiers who reported high preparedness more realistically appraised the threat involved in different levels of combat exposure, whereas less prepared soldiers perceived even low level combat as highly threatening. Perceived threat is thought to be an important link between combat experience and PTSD (i.e., the greater the perceived threat, the greater

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the likelihood of developing PTSD from the experience) (10, 16, 17, 32). Preparedness may play a role in the development of PTSD through its relationship with perceived threat, perhaps by reducing the level of threat perceived by soldiers in situations that are actually less threatening (30).

Reporting high levels of unit support, compared with low levels, also appeared protective against the development of PTSD from a deployment-related traumatic event. This result lends support to findings that suggest a positive influence of high levels of unit support and cohesion on mental health among U.K. and U.S. soldiers in the Iraq and Afghanistan conflicts who have experienced combat (18, 29). Receiving support from one's unit during deployment may promote soldiers' resilience to PTSD by increasing self-efficacy (i.e., personal belief in one's ability to handle situations or perform well) and/or mitigating the psychological consequences of war-zone stressors through strengthened coping abilities (18, 33, 34).

Postdeployment social support seemed to confer the most protection against PTSD of the three deployment characteristics evaluated in this study. Studies of both civilians and soldiers have documented postevent social support as a strong predictor of PTSD and other psychopathology (11, 13, 19, 35 38). Receiving support from others after a traumatic event may enhance an individual's coping abilities or influence how the individual evaluates the stressful situation and subsequently reacts to it emotionally and behaviorally, which may buffer the psychological consequences of traumatic event experience (39 42).

When we examined the combined effects of different deployment characteristics, we found that only characteristic combinations that included high postdeployment support (as opposed to low post-deployment support) were significantly associated with lower odds of PTSD (compared with the low preparedness, low unit support, low postdeployment support combination). This may provide evidence of the importance of postdeployment social support in preventing the development of PTSD from deployment-related traumatic events. It also suggests that for soldiers who experience low postdeployment support, being well prepared and/or having high unit support may not provide as strong a defense against post-deployment psychological illness.

This study benefited from its population-based design, allowing us to understand relations between deployment characteristics and PTSD in the OHARNG as a whole, although not generalizable to all branches of the military. It is important to note, however, that the cross-sectional nature of our study introduces limitations to the study findings; in particular, similar to other studies of deployment characteristics, results may suffer from the subjects' recall bias (18). For example, respondents' psychological well-being may have influenced their reporting of preparedness, unit support, and postdeployment support (18, 35, 43). To address this possible bias, prospective studies are necessary to examine preparedness, unit support and postdeployment support before and after deployment (18). We also faced challenges in our ability to accurately measure these deployment characteristics in relation to the most recent deployment among OHARNG members who have been deployed more than once (half of our sample population). It is possible that participants who have been deployed multiple times may differ in their reporting of these deployment characteristics. However, additional analysis found no significant differences between multiple deployment experience and reporting of deployment characteristics.

It is also possible that participants who have experienced multiple deployments will be unable to accurately recall deployment characteristics of their most recent deployment and will instead report aggregate feelings regarding all of their deployments. Studies that follow soldiers over time and assess deployment characteristics at multiple time points, as the soldier experiences additional deployments, would be fruitful. In addition, it has been suggested by Kanaisty and Norris (44) that social support may lead to less PTSD after a traumatic event in the period directly after the event (6−12 months) but that the inverse relation between social support and PTSD in later time points may be better explained by greater PTSD resulting in less social support. Because our study relied on cross-sectional data, we were unable to fully assess what may indeed be a reciprocal relation between social support and PTSD. Our conclusion that social support may be protective against the development of deployment-related, therefore, may be more accurate for the portion of participants who had experienced their most recent deployment in the past year. Finally, the use of a layperson assessment of PTSD prevented us from formally diagnosing respondents. We did, however, benefit from the use of a validated structured assessment of PTSD (as well as validated instruments for the three DRRI deployment characteristics). Clinical re-appraisal data suggest that, by eliminating those unlikely to have PTSD, the telephone assessment of PTSD has a high negative predictive value and may be a useful research tool. However it is also provides a very conservative screen that may miss PTSD cases and should not be used to facilitate clinical diagnosis (45).

Preparedness, unit support, and postdeployment support are examples of modifiable characteristics of deployment experience that may influence psychological outcomes independently and in combination. For example, reducing the number of soldiers who do not deploy with the unit through which they train may reduce the consequences of psychopathology after deployment. In addition, postdeployment support can be improved through means such as increasing access to chaplain services, employment support

groups, and improving mental health support services upon completion of deployment. Although observational data such as these are limited in their ability to suggest the outcomes of interventions, this study does suggest that future efforts to evaluate interventions that aim to improve postdeployment social support in particular may fruitfully point to approaches that mitigate the mental health consequences of war.

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Coincident posttraumatic stress disorder and depression predict alcohol abuse during and after deployment among Army National Guard soldiers[☆]

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ABSTRACT

Background: Although alcohol problems are common in military personnel, data examining the relationship between psychiatric conditions and alcohol abuse occurring de novo peri-/post-deployment are limited. We examined whether pre-existing or coincident depression and post-traumatic stress disorder (PTSD) predicted new onset peri-/post-deployment alcohol abuse among Ohio Army National Guard (OHARNG) soldiers.
Methods: We analyzed data from a sample of OHARNG who enlisted between June 2008 and February 2009. Participants who had ever been deployed and who did not report an alcohol abuse disorder prior to deployment were eligible. Participants completed interviews assessing alcohol abuse, depression, PTSD, and the timing of onset of these conditions. Logistic regression was used to determine the correlates of peri-/post-deployment alcohol abuse.
Results: Of 963 participants, 113 (11.7%) screened positive for peri-/post-deployment alcohol abuse, of whom 35 (34.0%) and 23 (32.9%) also reported peri-/post-deployment depression and PTSD, respectively. Soldiers with coincident depression (adjusted odds ratio [AOR] = 3.9, 95%CI: 2.0–7.2, $p < 0.01$) and PTSD (AOR = 2.7, 95%CI: 1.3–5.4, $p < 0.01$) were significantly more likely to screen positive for peri-/post-deployment alcohol abuse; in contrast, soldiers reporting pre-deployment depression or PTSD were at no greater risk for this outcome. The conditional probability of peri-/post-deployment alcohol abuse was 7.0%, 16.7%, 22.6%, and 43.8% among those with no peri-/post-deployment depression or PTSD, PTSD only, depression only, and both PTSD and depression, respectively.
Conclusions: Coincident depression and PTSD were predictive of developing peri-/post-deployment alcohol abuse, and thus may constitute an etiologic pathway through which deployment-related exposures increase the risk of alcohol-related problems.

1. Introduction

Excessive drinking and alcohol abuse have long been recognized as significant public health problems in the military (Greden et al., 1975). Recent studies from the United States and the United Kingdom have demonstrated that binge drinking and other alcohol-related problematic behaviors continue to be common among military personnel (Fear et al., 2007, 2010; Jacobson et al., 2008; Lande et al., 2008; Milliken et al., 2007). In addition to the well-characterized array of health hazards associated with excessive drinking (Eckardt et al., 1981), soldiers with alcohol problems are at increased risk for a host of adverse social and occupational consequences, including: loss of work productivity (Fisher et al., 2000), motor vehicle injury (Bell et al., 2000), criminal justice problems (Stahre et al., 2009), violence (McCarroll et al., 2009), and discharge from military service (Santiago et al., 2010). Previously identified risk factors for alcohol misuse in this population include: younger age (Bray and Hourani, 2007; Fear et al., 2007; Jacobson et al., 2008), male sex (Bray and Hourani, 2007; Jacobson et al., 2008), unmarried marital status (Fear et al.,

2007; Wilk et al., 2010), and having a family history of drug and alcohol problems (Fear et al., 2007, 2010). A growing body of literature has also examined the effect of deployment and specific combat exposures on alcohol abuse in active duty personnel and in soldiers of the Reserve and National Guards (Browne et al., 2008; Hooper et al., 2008; Jacobson et al., 2008; Wilk et al., 2010).

Fewer studies have investigated how psychopathology contributes to the risk for alcohol abuse during or following deployment. Preliminary evidence indicates that alcohol problems and psychiatric disorders are highly prevalent and appear to be comorbid in this population, particularly after return from theater (Fear et al., 2010; Hoge et al., 2004; Hotopf et al., 2006; Milliken et al., 2007; Wilk et al., 2010). For example, a recent study suggested that approximately half of soldiers who screen positive for depression or posttraumatic stress disorder (PTSD) also meet the criteria for potential alcohol misuse (Thomas et al., 2010). Furthermore, in a large cohort study of US military personnel, individuals with depression or PTSD were at an increased risk of continuing and new onset alcohol-related problems at follow-up (Jacobson et al., 2008).

While these studies have been instrumental in improving our understanding of the effects of combat on substance use and the mental health of soldiers, several important gaps in knowledge remain. First, while most studies of alcohol use in the military focus on active duty personnel, recent findings have suggested that soldiers of the Reserve and National Guard may be at an even higher risk for alcohol-related problems (Jacobson et al., 2008; Santiago et al., 2010). There is, however, very little data on alcohol abuse among reservists. Second, most previous research has failed to elucidate the timing of incident alcohol problems in relation to the onset of psychiatric disorders. It is therefore often unclear if alcohol use disorders and psychiatric conditions were prevalent at the time of deployment or if these conditions first manifested during or return from theater. The timing of these conditions in relation to deployment has important implications for screening interventions and other prevention programs. For example, if pre-existing psychiatric disorders are associated with peri-/post-deployment alcohol abuse, screening for these conditions prior to deployment may help to identify those at risk for developing substance abuse problems. In contrast, if psychiatric disorders and alcohol-related problems tend to be coincident during or following deployment (and occur even among previously low-risk persons), this would suggest shared or co-occurring deployment-related risk factors that could then be the focus of future prevention efforts. One recent study of Operation Iraqi Freedom (OIF)-deployed National Guard soldiers found that alcohol use disorders (AUDs) prior to deployment were associated with emotionality and disconstraint, whereas new onset AUDs following deployment were uniquely associated with post-deployment PTSD (Kehle et al., 2011). Although this study was limited by small sample size (only 17 participants reported new onset AUDs) and limited adjustment for potential sociodemographic and deployment-related confounders, the results provide preliminary evidence that post-deployment PTSD may be an important predictor of new onset alcohol problems among National Guard populations.

The primary objective of this analysis was to determine the prevalence of peri-/post-deployment alcohol abuse, depression, and PTSD among a sample of deployed National Guard who had never experienced an alcohol abuse disorder prior to active duty. We also sought to determine whether coincident depression and PTSD were associated with alcohol abuse first occurring during or following deployment, or whether these disorders preceded the manifestation of peri-/post-deployment alcohol abuse. Finally, we sought to determine the capacity of psychiatric disorders to act as clinical markers for peri-/post-deployment alcohol abuse in this population.

2. Methods

2.1. Study sample and data collection

Between November 2008 and November 2009, soldiers of the Ohio Army National Guard (OHARNG) were recruited to participate in the OHARNG Mental Health Initiative. This study aims to identify the risk factors and deployment-related exposures associated with psychiatric conditions experienced by OHARNG soldiers. The study population is all OHARNG who served between June 2008 and February 2009. Recruitment procedures were as follows. All soldiers with a current address ($n = 12,225$) were mailed a letter explaining the study's objectives and consenting procedures along with a pre-paid opt-out card. Addresses were obtained directly from the Ohio National Guard; thus, consent from the VA was not required to collect this information. Additional contact details were then obtained for all 11,212 (91.7%) individuals from whom an opt-out card was not received. We eliminated 1130 (10.1%) soldiers who did not have a telephone number listed with the guard and 3568 (31.8%) who had incorrect or non-active numbers, leaving 6514 (58.1%) potentially eligible participants. Of these individuals, 187 (2.9%) were not eligible (e.g., too young or retired), 1364 (20.9%) refused to participate, 31 (0.5%) were excluded for other reasons (e.g., did not speak English), and 2316 (35.6%) were not contacted before the cohort closed in November 2009. Informed consent was thus obtained and data collected from 2616 participants.

For this study, we excluded all participants who had never been deployed ($n = 939$, 35.9%) and 9 (0.3%) who refused to report deployment status, as the primary objective was to examine alcohol abuse disorders in relation to deployment. In order to compare individuals with peri-/post-deployment alcohol abuse to those with no lifetime history of alcohol abuse, we also excluded participants who reported an alcohol abuse disorder first occurring prior to their most recent deployment ($n = 613$, 23.4%). In addition we excluded 92 (3.5%) who did not answer one or more items used to assess the presence and timing of an alcohol abuse disorder. The final eligible analytic sample was $n = 963$.

Computer-assisted telephone interviewing was used to collect a wide array of information regarding sociodemographic characteristics, current living situation, military history, deployment and combat experiences, and past and present symptoms of psychopathology. Where possible, validated survey instruments (see below) were used to assess symptom timing, duration, and degree of impairment. Interviews took approximately 60 min to complete. All participants were compensated for their time and a clinician was on call to speak to participants who expressed feeling disturbed at any point during or after the survey. The study received a certificate of confidentiality from the National Institutes of Health and the study protocol was approved by the Institutional Review Boards of University Hospitals Case Medical Center, University of Toledo, and Columbia University. The study was also approved by the Human Research Protection Office (HRPO), Office of Research Protections (ORP), and the U.S. Army Medical Research and Materiel Command (USAMRMC) of the United States Department of Defense.

2.2. Measures

The main outcome for this analysis was screening positive for alcohol abuse and reporting these symptoms as first occurring during or following one's most recent deployment (yes vs. no). The Mini International Neuropsychiatric Interview (MINI) and DSM-IV criteria were used to determine the presence of alcohol abuse (i.e., reporting at least one maladaptive pattern of alcohol use leading to clinically significant impairment or distress; American Psychiatric Association, 2000; Sheehan et al., 1998). In accordance with previous studies (Kessler et al., 2005; Wells et al., 2006), alcohol abuse disorders were diagnosed without hierarchy (i.e., regardless of whether a dependence diagnosis was present), in recognition that abuse is often a stage in the progression to dependence. Participants screening positive for alcohol abuse were then asked at what age they first had the symptoms. If the age of symptom onset was at least one year after the participant's most recent deployment, she/he was categorized as having post-deployment alcohol abuse. Individuals who reported having symptoms the same year as their most recent deployment were asked to clarify if the symptoms started before, during or after deployment. Individuals who reported that symptoms started during or after their most recent deployment were also defined as having peri-/post-deployment alcohol abuse.

The primary exposures of interest were screening positive for pre-deployment or peri-/post-deployment depression and/or PTSD. The Primary Care Evaluation of Mental Health Disorders Patient Health Questionnaire-9 (PHQ-9) was used to assess for depression (Kroenke and Spitzer, 2002; Kroenke et al., 2001). To screen positive for depressive disorder, a participant had to score ≥ 2 of 9 symptoms on the PHQ-9, and these symptoms had to occur together within a 2-week period along with either depressed mood or anhedonia. Although a conservative cut-off of ≥ 5 has been used to assess for major depressive disorder, we opted to use a more sensitive measure to screen for any depression, which has been validated and used previously (Calabrese et al., 2011). If participants screened positive for depression, they were asked at what age these symptoms first began and were also asked to clarify if the symptoms occurred before, during or after their most recent deployment. The PTSD Checklist-Civilian Version (PCL-C) was used to measure PTSD symptoms (Blake et al., 1995). We used the 17-item instrument to assess PTSD-related symptoms in relation to two events: participants' self-identified "worst" event that occurred during

their most recent deployment, and an event that was unrelated to this deployment. The diagnostic criteria for PTSD parallels that of the DSM-IV; thus, participants screened positive for PTSD if he/she reported experiencing a qualifying trauma, at least one intrusion symptom, at least three symptoms of avoidance, and at least two hyperarousal symptoms. Symptoms must also have lasted for at least a month and caused significant social or functional impairment. For PTSD cases due to a traumatic event unrelated to the soldier's most recent deployment, the date of the traumatic event was used to estimate the earliest PTSD could have occurred. All persons with PTSD cases arising from a traumatic event during or after return from deployment were considered to have peri-/post-deployment PTSD. Both the PHQ-9 and PCL-C have been found to be reliable and valid instruments in both general and military personnel populations (Blanchard et al., 1996; Maguen et al., 2010; Martin et al., 2006).

Other variables assessed included the following sociodemographic characteristics, which have been shown in previous studies of military personnel to be associated with alcohol abuse (Bray and Hourani, 2007; Bray et al., 1991; Ferrier-Auerbach et al., 2009; Jacobson et al., 2008; Lande et al., 2008): sex (male vs. female), age, self-identified racial background (white, black, other), income ($\leq$\$60,000 vs. >\$60,000), education (high school graduate, some college or technical training, college/graduate degree), marital status (never married, divorced/separated/widowed, married), smoking history (ever vs. never), self-reported family history of drug or alcohol abuse (yes vs. no), and number of previous deployments (1, 2–3, >3). We also included as a covariate most recent deployment setting (conflict vs. non-conflict), based on research demonstrating a high prevalence of problem drinking among soldiers experiencing combat (Hooper et al., 2008; Lande et al., 2008; Wilk et al., 2010).

2.3. Statistical analyses

As a first step, we compared the sociodemographic characteristics of those who reported a peri-/post-deployment alcohol abuse disorder versus those with no lifetime history of alcohol abuse using Pearson's χ^2 test. We also used Pearson χ^2 test to examine the associations between peri-/post-deployment alcohol abuse and the presence and timing of the psychiatric disorders of interest (i.e., none in lifetime, prior to deployment, peri-/post-deployment). We then constructed a multivariable logistic regression model to determine the independent associations between peri-/post-deployment alcohol abuse and depression or PTSD developed at different stages in relation to deployment. All covariates assessed in bivariable analysis were included in the final model in order to provide as complete control of confounding as possible given the data set (Hosmer and Lemeshow, 2000).

As a final step, we conducted reverse logit transformations to examine the predictive capacity of peri-/post-deployment depression and PTSD, using the relevant coefficients derived from the multivariate model. We computed the conditional probability of reporting peri-/post-deployment alcohol abuse, given the presence of no psychiatric conditions, peri-/post-deployment depression only, peri-/post-deployment PTSD only, and both peri-/post-deployment depression and PTSD. Each conditional probability was weighted by the sample prevalence of the other covariates to estimate population averages. All statistical analyses were conducted in SAS 9.1, and all p-values are two-sided.

3. Results

3.1. Sample characteristics

The characteristics of the 963 eligible participants are described in Table 1. The majority of participants were male (87.3%), less than 35 years of age (59.6%), white (86.1%) and married (56.2%). The sociodemographic characteristics of the sample were similar to the entire OHARNG, with no significant differences with respect to gender ($p = 0.53$) or race ($p = 0.34$); however, the sample was slightly older ($p < 0.01$) and more likely to be married ($p < 0.01$). A total of 113 (11.7%) participants reported an alcohol abuse disorder that first occurred during or post-deployment. As shown in Table 1,

Table 1
Sociodemographic factors associated with peri-/post-deployment alcohol abuse[a] among a sample of Ohio Army National Guard who have ever been deployed.

Characteristic	Total (%)[b] (n = 963)	Peri-/post-deployment alcohol abuse[a]		p-Value
		Yes (%) (n = 113)	No (%) (n = 850)	
Sex				
Men	841 (87.3)	109 (13.0)	732 (87.0)	<0.01
Women	122 (12.7)	4 (3.3)	118 (96.7)	
Age (years)				
17–24	200 (20.8)	29 (14.5)	171 (85.5)	<0.01
25–34	373 (38.8)	55 (14.8)	318 (85.3)	
35–44	281 (29.2)	25 (8.9)	256 (91.1)	
$\geq$45	107 (11.1)	4 (3.7)	103 (96.3)	
Race				
White	828 (86.1)	105 (12.7)	723 (87.3)	0.07
Black	85 (8.8)	4 (4.7)	81 (95.3)	
Other	49 (5.1)	4 (8.2)	45 (91.8)	
Income				
> \$60,000	413 (43.7)	40 (9.7)	373 (90.3)	0.07
$\leq$\$60,000	532 (56.3)	72 (13.5)	460 (86.5)	
Education				
High school graduate	223 (23.2)	28 (12.6)	195 (87.4)	0.28
Some college or technical training	484 (50.3)	62 (12.8)	422 (87.2)	
College/graduate degree	256 (26.6)	23 (9.0)	233 (91.0)	
Marital status				
Married	539 (56.2)	44 (8.2)	495 (91.8)	<0.01
Divorced/separated/widowed	106 (11.0)	17 (16.0)	89 (84.0)	
Never married	315 (32.8)	51 (16.2)	264 (83.8)	
Smoking history				
Ever	516 (55.1)	79 (15.3)	437 (84.7)	<0.01
Never	420 (44.9)	32 (7.6)	388 (92.4)	
Family history of drug/alcohol abuse				
Yes	188 (19.5)	25 (13.3)	163 (86.7)	0.46
No	775 (80.5)	88 (11.4)	687 (88.7)	
Number of deployments				
1	511 (53.1)	73 (14.3)	438 (85.7)	0.02
2–3	372 (38.6)	31 (8.3)	341 (91.7)	
>3	80 (8.3)	9 (11.3)	71 (8.8)	
Most recent deployment setting				
Conflict	435 (45.2)	74 (17.0)	361 (83.0)	<0.01
Non-conflict	528 (54.8)	39 (7.4)	489 (92.6)	

[a] Defined as an alcohol abuse disorder meeting DSM-IV criteria first occurring during or following deployment. Persons reporting an alcohol disorder prior to deployment were excluded from analysis.
[b] Not all columns add to 100% due to missing values.

Table 2
Psychiatric conditions associated with peri-/post-deployment alcohol abuse[a] among a sample of Ohio Army National who have ever been deployed.

Characteristic	Total (%)[b] (n = 963)	Peri-/post-deployment alcohol abuse[a]		p-Value
		Yes (%) (n = 113)	No (%) (n = 850)	
Depressive disorder				
None in lifetime	766 (80.1)	72 (9.4)	694 (90.6)	<0.01
First occurring prior to deployment	87 (9.1)	6 (6.9)	81 (93.1)	
First occurring during/post deployment	103 (10.8)	35 (34.0)	68 (66.0)	
Posttraumatic stress disorder (PTSD)				
None in lifetime	775 (89.0)	76 (9.8)	699 (90.2)	<0.01
First occurring prior to deployment	26 (3.0)	3 (11.5)	23 (88.5)	
First occurring during/post deployment	70 (8.0)	23 (32.9)	47 (67.1)	

[a] Defined as an alcohol abuse disorder meeting DSM-IV criteria first occurring during or following deployment. Persons reporting an alcohol disorder prior to deployment were excluded from analysis.
[b] Not all columns add to 100% due to missing values.

individuals reporting peri-/post-deployment alcohol abuse were more likely to be men, of younger age, non-married, only deployed once, and most recently deployed to a conflict setting (all $p < 0.01$).

3.2. Effects of depression and PTSD on peri-/post-deployment alcohol abuse

We examined the prevalence of peri-/post-deployment alcohol abuse among soldiers reporting coincident depression or PTSD, among those who reported depression or PTSD prior to deployment, and among those who never experienced these conditions. As shown in Table 2, the prevalence of peri-/post-deployment alcohol abuse was low among those who never experienced depression (9.4%), and also among those who reported no lifetime history of PTSD (9.8%). Similarly, peri-/post-deployment alcohol abuse was uncommon among the small subset of participants who reported onset of depression or PTSD prior to their deployment (6.9% and 11.5%, respectively). In contrast, the prevalence of peri-/post-deployment alcohol abuse was elevated among participants who also reported peri-/post-deployment depression and PTSD:

34.0% and 32.9%, respectively. Of the 113 persons who reported peri-/post-deployment alcohol abuse, 35 (31.0%) reported coincident depression, 23 (20.4%) reported coincident PTSD, and 15 (13.3%) reported both conditions. In bivariable analyses (Table 2), coincident depression ($p < 0.01$) and PTSD ($p < 0.01$) were both significantly associated with peri-/post-deployment alcohol abuse. Among the subset of 27 participants reporting depression onset during deployment, 17 (63.0%) reported no alcohol abuse, two (7.4%) reported concurrent onset of alcohol abuse, and eight (29.6%) reported alcohol problems first occurring after deployment. Only one individual reported onset of PTSD symptoms during deployment.

The results of the multivariable model examining the independent effects of coincident depression and PTSD on peri-/post-deployment alcohol abuse are shown in Table 3. Even after extensive adjustment for potential confounding, peri-/post-deployment depression (adjusted odds ratio [AOR] = 3.9, 95%CI: 2.0–7.2) and peri-/post-deployment PTSD (AOR = 2.7, 95%CI: 1.3–5.4) were significantly associated with the outcome of interest. Experiencing depression or PTSD prior to deployment had no
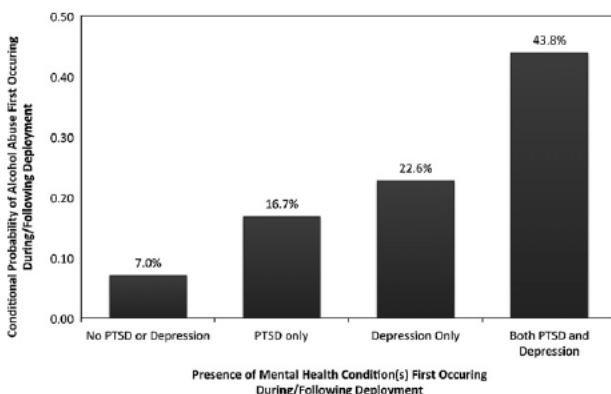
Table 3
Multivariate regression of factors associated with peri-/post-deployment alcohol abuse[a] among a sample of Ohio Army National Guard who have ever been deployed (n = 847[b]).

Characteristic	AOR	95% CI	p-Value
Sex (male vs. female)	7.9	2.6–23.8	<0.01
Age (ref: 17–24)	–		–
25–34	1.5	0.8–2.9	0.23
35–44	0.9	0.4–2.0	0.73
≥45	0.4	0.1–1.5	0.18
Race (ref: white)	–		–
Black	0.4	0.1–1.3	0.14
Other	0.9	0.3–2.8	0.83
Income (≤$60,000 vs. >$60,000)	1.4	0.8–2.4	0.22
Education (ref: high school graduate)	–		–
Some college	1.1	0.6–2.0	0.66
College/graduate degree	1.0	0.5–2.1	0.97
Marital status (ref: married)	–		–
Divorced/separated/widowed	2.6	1.2–5.6	0.01
Never married	2.6	1.4–4.8	<0.01
Family history of drug/alcohol abuse (yes vs. no)	0.9	0.5–1.7	0.79
Smoking history (ever vs. never)	1.9	1.1–3.1	0.01
Most recent deployment setting (conflict vs. con-conflict)	2.4	1.5–3.9	<0.01
Prior number of deployments (ref: 1)	–		–
2–3	0.4	0.2–0.7	<0.01
>3	0.7	0.3–1.8	0.44
Depressive disorder (ref: none in lifetime)	–		–
First occurring prior to deployment	0.7	0.3–1.8	0.44
First occurring during/post deployment	3.9	2.0–7.2	<0.01
Posttraumatic stress disorder (ref: none in lifetime)	–		–
First occurring prior to deployment	0.9	0.1–4.7	0.87
First occurring during/post deployment	2.7	1.3–5.4	<0.01

[a] Defined as an alcohol abuse disorder meeting DSM-IV criteria first occurring during or following deployment. Persons reporting an alcohol disorder prior to deployment were excluded from analysis.
[b] Some participants were excluded from multivariate regression due to missing values.

Fig. 1. Estimated conditional probabilities of peri-/post-deployment alcohol abuse among a sample of Ohio Army National Guard who have ever been deployed. Note: conditional probabilities were derived from reverse logit transformations of the coefficients presented in Table 3 and are adjusted for other variables entered in the multivariate regression model. Note: depression and PTSD are both defined as first occurring during or following deployment.

effect on the likelihood of the outcome. In the final model, male sex, never married or divorced/separated/widowed marital status, ever smoking, and being deployed to a conflict setting were also positively associated with peri-/post-deployment alcohol abuse. A lifetime history of multiple deployments (i.e., 2–3) was negatively associated with the outcome.

3.3. Predictive capacity of depression and PTSD

Reverse logit transformations of the coefficients from the multivariate model were used to estimate the conditional probability of peri-/post-deployment alcohol abuse in the study sample. As shown in Fig. 1, given the absence of coincident depression and PTSD, the conditional probability of having a peri-/post-deployment alcohol abuse disorder was 7.0% (95%CI: 2.7–16.9%). Among participants who reported peri-/post-deployment PTSD or depression, the estimated conditional probability of this outcome was 16.7% (95%CI: 5.9–39.2%) and 22.6% (95%CI: 9.2–45.7%), respectively. In the presence of both conditions, the conditional probability of peri-/post-deployment alcohol abuse rose sharply to 43.8% (95%CI: 20.6–70.1%).

4. Discussion

In a sample of OHARNG soldiers, we observed a high prevalence of peri-/post-deployment alcohol abuse among persons who reported not having an alcohol use disorder prior to their most recent deployment. Coincident psychiatric disorders were common: among persons with alcohol abuse first occurring during or following deployment, 31% and 20% also screened positive for peri-/post-deployment depression and PTSD, respectively. In a multivariable regression model, pre-existing psychiatric conditions were not associated with alcohol abuse first manifesting during or following deployment, while coincident depression and PTSD were highly predictive of peri-/post-deployment alcohol-related problems.

These findings support a growing literature indicating that deployed National Guard are at high risk for developing alcohol abuse after return from theater (Jacobson et al., 2008; Milliken et al., 2007; Santiago et al., 2010). In fact, previous studies have shown that compared to Active Component personnel, National Guard soldiers are more likely to engage in alcohol-related behavior (e.g., drinking and driving) and are less likely to enter substance abuse treatment after return from theater (Jacobson et al., 2008; Santiago et al., 2010). These findings, in addition to the results of the

present study, indicate the urgent need to evaluate the availability and uptake of alcohol treatment interventions for this population.

Consistent with previous research, new onset alcohol abuse was particularly common among males, unmarried persons, and soldiers deployed to a conflict setting (Bray and Hourani, 2007; Fear et al., 2007; Hooper et al., 2008; Jacobson et al., 2008; Santiago et al., 2010; Wilk et al., 2010). A novel finding of this study is that preexisting depression and PTSD were not found to be risk factors for the development of peri-/post-deployment alcohol-related problems. One possible explanation is that many participants with preexisting psychiatric conditions would have already developed alcohol abuse prior to deployment and thus were excluded from the analytic sample. It is also possible that persons with a lifetime history of severe depression or PTSD were identified prior to deployment and either counseled or not sent to theater; therefore, this group may represent a population with milder symptomatology compared to those who developed depression or PTSD during or following deployment. Regardless of the underlying mechanism of action, screening for these disorders upon enlistment would be unlikely to identify soldiers at high risk for deployment-related alcohol problems.

The finding that psychiatric disorders were frequently coincident with new onset alcohol abuse may indicate a common set of deployment-related risk factors for both psychiatric and alcohol use disorders. This "shared environmental risk factor" model has been proposed previously to explain the high prevalence of comorbid PTSD and substance use disorders among persons experiencing trauma (Breslau et al., 2003). However, we cannot preclude the possibility that the risk factors for alcohol abuse and PTSD are not shared, but simply co-occur in this population. Additionally, some literature suggests that underlying genetic vulnerability modifies the risk of comorbid psychiatric disorders after exposure to traumatic events, including combat (Kilpatrick et al., 2007; Koenen et al., 2003). Although recent studies have begun to elucidate how specific combat experiences increase the risk of both mental illness and alcohol abuse following deployment (Browne et al., 2008; Hoge et al., 2006; Hooper et al., 2008; Wilk et al., 2010), more research is required to determine whether these exposures constitute a common etiologic pathway that drives both substance use and psychiatric conditions in soldiers of the National Guard.

There are several other possible explanations for the observed associations between peri-/post-deployment alcohol abuse and coincident psychiatric problems. One hypothesis, discussed previously (McFarlane, 1998), is that persons with depression or PTSD self-medicate with alcohol to cope with negative affect and perceived stress. Thus, soldiers who develop depression and/or PTSD after being exposed to a deployment-related traumatic event may rely on alcohol as a way to self-medicate emotional suffering (Ferrier-Auerbach et al., 2009). This hypothesis is supported by our finding that new onset alcohol abuse was most common among persons experiencing both peri-/post-deployment depression and PTSD, given that the co-occurrence of these conditions following trauma interacts to increase distress and functional impairment (Shalev et al., 1998). However, it is also possible that heavy alcohol use following deployment increases the likelihood of developing depression or PTSD in the event that trauma has been experienced (Stewart, 1996). Evidence for this hypothesis comes from several studies demonstrating that incident substance abuse disorders following trauma are elevated only in persons who developed PTSD (Breslau et al., 2003). Although we are unable to determine the precise order of peri-/post-deployment alcohol abuse and psychiatric disorders in this study, the coincident nature of these events highlights the need for comprehensive screening and support services for individuals experiencing comorbid psychiatric and alcohol abuse disorders in this population.

There are several strengths of the study, including its rigorous sampling procedures, reliance on DSM-IV criteria to define

the primary outcome and exposures of interest, and the ability to determine the timing of new onset alcohol abuse and psychiatric disorders in relation to deployment. As for study limitations, we note that these data are cross-sectional and thus the timing of the outcome and exposures were retrospectively self-reported. Future analyses will utilize prospectively collected data to validate these findings. Second, the results may be subject to recall bias. It is possible that participants who recalled developing alcohol problems may have been more likely to also remember having psychiatric disorders during the same time period. Third, we may have misclassified persons surveyed shortly after their return from deployment, since prior research demonstrates increased rates of psychiatric symptoms 3–4 months after deployment (Bliese et al., 2007). If present, this bias would result in an underestimate of the true prevalence of new onset psychiatric and alcohol-related problems. Fourth, given the small number of women in the study, we caution that the observed results may not be generalizable to female National Guard soldiers. Furthermore, we were unable to conduct interaction analyses between sex and the mental disorder variables of interest. Finally, although consistent with the DSM-IV, we note that a diagnosis for alcohol abuse required a positive response to only one (or more) of the four criteria, and is thus a sensitive measure of an alcohol disorder. While many studies have demonstrated the predictive validity of DSM-IV alcohol abuse (Hasin and Paykin, 1999; Hasin et al., 1990; Schuckit et al., 2001), the DSM-V Substance Use Disorders Workgroup has recommended that abuse and dependence be combined into a single alcohol disorder of graded clinical severity (American Psychiatric Association, 2011). Future studies will be required to establish the validity of this new measure in military populations.

Given that heavy alcohol use is of significant concern in military personnel (Bray and Hourani, 2007), these findings have important implications for intervention and policy. Historically, uptake of treatment services for alcohol problems in the military has been low, likely due to the fact that accessing these programs is non-confidential and can be perceived as having negative career ramifications (Jacobson et al., 2008). Furthermore, unlike Active Component soldiers, National Guard soldiers do not have uninterrupted access to care, and free military medical coverage lasts only six months following their deployment (Thomas et al., 2010). The high prevalence of peri-/post-deployment alcohol abuse observed in this and other samples of National Guard soldiers suggests that policies which promote improved access to care and encourage utilization of confidential drug and alcohol treatment services merit consideration. Several interventions that utilize one-on-one interviewing and Web-based tools to improve perceptions of privacy have been shown to be efficacious and should continue to be evaluated (Fernandez et al., 2006; Jacobson et al., 2008). Furthermore, physicians treating deployed National Guard for psychiatric conditions including depression and PTSD should be aware that these conditions are highly predictive of concurrent alcohol abuse disorders. Given that persons with comorbid alcohol abuse and psychiatric disorders experience significant disability and reduced quality of life (Andrews et al., 2001), it is recommended that soldiers reporting multiple coincident conditions during or following deployment have ready access to comprehensive and confidential care.

This study demonstrated that incident alcohol abuse during and following deployment is common in soldiers of the Ohio Army National Guard. Furthermore, persons who experience peri-/post-deployment psychiatric disorders are at the greatest risk of developing alcohol-related problems. Although further research is required to elucidate whether deployment-related psychiatric conditions precede substance use disorders or share a common etiology with them, these findings point to the need for comprehensive screening and support services for National Guard with comorbid psychiatric and substance abuse conditions.

Contributors

Author SG had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the analysis. Authors BDLM, MRP, and SG designed the study and wrote the protocol. Authors IL, MBT, JRC and SG were responsible for obtaining study funding and acquiring the data. Author BDLM managed the literature searches and summaries of previously published related work. Author MRP undertook the statistical analysis with significant scientific input from BDLM and SG. Author BDLM wrote the first draft of the manuscript and authors MRP, IL, MBT, JRC, and SG contributed to its content and critical revision of the manuscript for important intellectual content. All authors approved the final manuscript.

Conflict of interest

Dr. Calabrese has received federal funding from the Department of Defense, Health Resources Services Administration and National Institute of Mental Health; has received research support from Abbott, AstraZeneca, Bristol-Myers Squibb, Cephalon, Cleveland Foundation, Eli Lilly, GlaxoSmithKline, Janssen, NARSAD, Repligen, Stanley Medical Research Institute, Takeda and Wyeth; has consulted to or served on advisory boards of Abbott, AstraZeneca, Bristol-Myers Squibb, Cephalon, Dainippon Sumitomo, EPI-Q, Inc., Forest, France Foundation, GlaxoSmithKline, Janssen, Johnson and Johnson, Lundbeck, Neurosearch, OrthoMcNeil, Otsuka, Pfizer, Repligen, Schering-Plough, Servier, Solvay, Supernus, Synosia, and Wyeth; has provided CME lectures supported by Abbott, AstraZeneca, Bristol-Myers Squibb, France Foundation, GlaxoSmithKline, Janssen, Johnson and Johnson, Sanofi Aventis, Schering-Plough, Pfizer, Solvay, and Wyeth; has no speaker bureaus for the past 8 years (past speaker bureaus included Abbott, AstraZeneca, Eli Lilly, and GlaxoSmithKline); has no stock, no equity, and no patents. All other authors declare that they have no conflicts of interest.

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Running head: Factor structure of depression

The factor structure of major depression symptoms:
A test of four competing models using the Patient Health Questionnaire-9

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Abstract

Little research has examined the underlying symptom structure of major depressive disorder symptoms based on *DSM-IV* criteria. Our aim was to analyze the symptom structure of major depression, using the Patient Health Questionnaire-9 (PHQ-9). The PHQ-9 was administered to a sample of 2,615 Army National Guard soldiers from Ohio. A one-factor model of depression and three separate two-factor models previously established in the literature were evaluated using confirmatory factor analysis. Results demonstrated greater support for the two-factor models of depression than for the one-factor model. The best fitting model was the two-factor model of somatic and non-somatic symptoms supported previously by Krause et al. (2010) and Richardson and Richards (2008). Implications for understanding the components and mechanisms of major depressive disorder are discussed.

Keywords: depression; confirmatory factor analysis; military veterans; Patient Health Questionnaire-9

1. Introduction

A substantial body of research has investigated the underlying symptom structure of depression symptoms (Shafer, 2006). However, this body of research has rarely used depression measures with items that map onto *DSM-IV* symptom criteria for major depressive disorder (MDD). Thus, little is known about the symptom structure of *DSM-IV*-based MDD. The Patient Health Questionnaire-9 (PHQ-9), on the other hand, is one of the few depression screening instruments comprising items that map onto *DSM-IV* diagnostic criteria for MDD symptoms. Although the PHQ-9 has been well-researched and used, few studies have assessed its factor structure.

The PHQ-9 is a nine-item major depression module from the Primary Care Evaluation of Mental Disorders (PRIME-MD), a standardized assessment for mood, anxiety, somatoform, alcohol-related, and eating disorders (Spitzer et al., 1994). It was originally designed for the purpose of screening in primary care, an important issue because primary care is the most frequent setting in which individuals seek treatment for mental health reasons (Wang et al., 2006). The PHQ-9 items are self-rated and map onto *DSM-IV* symptom criteria for MDD. An additional item assesses the impact of depressive symptoms on functional impairment. Psychometric evidence demonstrates adequate construct and criterion validity across diverse samples of civilian primary care and obstetrics-gynecology patients (Kroenke et al., 2010; Flynn et al., 2011). Total cut-off scores of 5, 10, 15 and 20 represent "mild," "moderate," "moderately severe," and "severe" (clinically diagnosable) depression respectively; although these labels should not be confused with similar specifiers for major depression from *DSM-IV*. The PHQ-9 diagnostic scoring algorithm corresponds to *DSM-IV* MDD requirements, wherein five or more

items must be recently experienced at least "more than half the days," with one symptom being depressed mood and/or anhedonia (Kroenke et al., 2001).

There is a paucity of research on the factor structure of *DSM-IV*-based MDD symptoms. The PHQ-9 is an instrument that queries such symptoms. It is true that the Major Depression Inventory (MDI) (Olsen et al., 2003) is another instrument of *DSM-IV*-based MDD symptoms. Despite being analyzed using item response theory which assumes unidimensionality, the MDI's factor structure has not been investigated. Research is necessary in understanding the latent structure and mechanisms underlying MDD, and studying the PHQ-9 is one means of examining this relatively unexplored research area.

Several studies have used exploratory factor analysis (EFA) to discover relatively unique sets or "factors" of PHQ-9 items that are correlated with each other, in samples of primary care patients, outpatient substance abusers and spinal cord injury patients (Huang et al., 2006; Cameron et al., 2008; Dum et al., 2008; Kalpakjian et al., 2009; Krause et al., 2010). Other studies have used confirmatory factor analysis to test hypothesized models generated from EFA studies, using samples of spinal cord injury and primary care patients (Krause et al., 2008; Baas et al., 2011). Some EFA studies (Huang et al., 2006; Cameron et al., 2008; Dum et al., 2008; Kalpakjian et al., 2009) and CFA studies of the PHQ found support for a one-factor model (Baas et al., 2011), reflecting unidimensionality of the depression construct. Other EFA studies (Richardson and Richards, 2008; Krause et al., 2010) and a CFA study (Krause et al., 2008) found support for a two-factor PHQ model, with one factor primarily based on somatic items (e.g., sleep difficulties, appetite changes and fatigue) and the other factor primarily based on non-somatic or affective items (e.g., depressed mood, feelings of worthlessness and suicidal thoughts). Importantly, these studies typically investigated only one depression model per paper.

Lacking in the literature is a comprehensive evaluation of the various depression factor models, from a *DSM-IV*-based instrument such as the PHQ-9, tested against each other using objective statistical criteria.

We believe that using CFA is more defensible in examining the structure of MDD symptoms, and we built on this area in the present paper. EFA is exploratory and capitalizes on chance error in statistically "discovering" the best patterns of item sets based on computer-generated mathematical algorithms. Given the substantial Type I error, and lack of ability to narrowly specify hypothesized models of interest in EFA a priori, EFA findings do not often cross-validate with other samples (Fabrigar et al., 1999). Unlike EFA, CFA requires the testing of a specifically hypothesized model (or models), evaluating how well the model's patterns of intercorrelations are represented in the observed data (Bollen, 1989; Kline, 2010).

The PHQ-9's depression models derived from EFA and CFA have important implications for understanding the core components of depression – specifically, with implications for underlying dimensions and mechanisms of the disorder. For example, three PHQ-9 items have consistently been found represented by the somatic factor (sleep difficulties, appetite changes and fatigue); three additional items have been represented by the affective/non-somatic factor (depressed mood, feelings of worthlessness and thoughts of death) (Krause et al., 2008; Richardson and Richards, 2008; Krause et al., 2010). These preliminary studies thus suggest somatic and affective components of MDD that may have implications for the disorder's underlying mechanisms. Additionally, the psychomotor difficulties item was less represented by the somatic and non-somatic factors (Krause et al., 2008; Krause et al., 2010), thus possibly reflecting that this symptom may not be as strong of a general depression marker.

The current study aimed to study the factor structure of *DSM-IV*-based MDD symptoms by comparing four empirically-supported models using CFA to assess which model fits best. We used the PHQ-9 to examine our research question. We used objective statistical criteria to judge and compare model fit. Our sample included a large, regional epidemiological sample of National Guard soldiers, many of whom had been deployed to a war zone which places soldiers at risk of depression soon and months after returning from combat (Grieger et al., 2006). This sampling plan broadens previous research on the PHQ-9's factor structure from the restricted samples that have included patients with spinal cord injury (Krause et al., 2008; Richardson and Richards, 2008; Kalpakjian et al., 2009; Krause et al., 2010), and primary care patients (Huang et al., 2006; Baas et al., 2011). We found no studies examining the PHQ's factor structure among a military population.

2. Method

2.1. Participants and Procedure

The present study was part of the Ohio Army National Guard Mental Health Initiative, a large-scale epidemiological study of mental health among National Guard soldiers in Ohio. We initially invited all members of the Ohio National Guard who served between July 2008 and February 2009 for participation in the telephone interview portion of the study, executed through an alert letter. 12,225 Guard members with a valid mailing address were invited to participate (345 additional individuals were excluded for having no mailing address). Among the pool of potential subjects, 1,013 (8.3%) declined to participate, 1,130 (10.1%) did not have a telephone number listed with the Guard, and 3,568 (31.8%) did not have a correct or working phone number. Among the remaining 6,514 Guard members (58.1%), the following individuals were excluded: 187 (2.8%) based on age eligibility restrictions, 1,364 (20.9%) declined to participate,

31 (0.4%) for having English language or hearing difficulties, and 2,316 (35.5%) for not being contacted before the cohort was closed to new recruitment. Of the remaining 2,616 subjects, one subject was excluded for missing six items on our primary measure (PHQ-9), leaving 2,615 participants.

Age ranged from 17 to 61 years ($M = 30.69$, $SD = 9.50$). Most participants were men ($n = 2,227$, 85.2%), with 388 women (14.8%). The vast majority of participants were either currently married ($n = 1,227$, 47.0%) or had never been married ($n = 1,133$, 43.4%). A small proportion of respondents were of Hispanic ethnicity ($n = 82$, 3.1%). Most identified their racial background as Caucasian ($n = 2,295$, 87.9%), or African American ($n = 194$, 7.4%). The majority had some college or technical school education ($n = 1,233$, 47.2%), a completed college education ($n = 466$, 17.8) or a terminal high school or equivalent degree ($n = 598$, 22.9%). Participants were primarily employed full-time ($n = 1,560$, 59.9%), part-time ($n = 340$, 13.1%), unemployed ($n = 419$, 16.1%) or of student status ($n = 244$, 9.4%). Household income of $20,000 or less was reported by 326 participants (12.9%), between $20,001 and $40,000 by 604 respondents (23.8%), between $40,001 and $60,000 by 568 participants (22.4%), between $60,001 and $80,000 by 426 (16.8%), and more than $80,000 by 611 participants (24.1%). Service in the military ranged from 0 to 50 years ($M = 10.08$, $SD = 8.41$). Roughly one-third of the sample had never been deployed ($n = 939$, 36.0%), while most deployed participants reported being deployed once ($n = 816$, 31.3%), twice ($n = 469$, 18.0%), or three times ($n = 213$, 8.2%). 765 participants (46.0%) had been deployed to Iraq or Afghanistan between 2003-2009.

Study enrollment began in November 2008 and ended in November 2009. The National Guard Bureau, Office of Human Research Protections of the U.S. Army Medical Research and Materiel Command, along with several affiliated hospital and university institutional review

boards, approved the study, with written informed consent waived in lieu of verbal consent by telephone. We complied with the Declaration of Helsinki in ethically conducting this research.

2.2. Instrumentation

A computer-assisted telephone interview was conducted for all participants by trained professionals, to assess demographic characteristics and mental health functioning using standardized questionnaires.

Of relevance to the present study, the PHQ-9 was administered by telephone (Kroenke et al., 2001). The PHQ-9 measures depression symptoms over the previous two weeks based on *DSM-IV* major depressive episode symptom criteria. We modified the instructions in order to query depression symptoms over the course of the respondent's lifetime; support for this approach was found in Cannon et al. (2007). The PHQ-9 is a Likert-type self-report instrument with four response options ranging from "*0 = Not at all*" to "*3 = Nearly every day.*" As a severity measure, scores on the PHQ-9 range from zero to 27. Internal consistency has ranged from 0.86 to 0.89 (Kroenke et al., 2001) (alpha = 0.86 in the present sample). Test-retest reliability within 48 hours was $r = 0.84$. Diagnostic validity has been demonstrated in detecting an MDD diagnosis based on structured diagnostic interviews. Lastly, construct validity is reflected in the association of PHQ-9 severity scores and measures of functional status, number of disability days and difficulties based on symptoms (Kroenke et al., 2001).

2.3. Analysis

Of the 2,615 participants, 62 were missing between one to two PHQ items each, and one subject missed three items. We used multiple imputation procedures with an iterative Markov chain Monte Carlo method and the Gibbs Sampler procedure (in SPSS's Version 17 Missing Value Analysis software) to estimate missing item-level PHQ data, generated across 10 imputed

datasets. CFA analyses were conducted using Mplus 6.1 software, averaging parameter estimates across the 10 imputed datasets. Three PHQ items had kurtosis values greater than 2.0, thus deemed non-normally distributed. Therefore CFA analyses implemented maximum likelihood estimation with a mean-adjustment, using the Satorra-Bentler chi-square value which is robust to non-normality (Satorra and Bentler, 2001).

CFA analyses were implemented by specifying the four models discussed above (and displayed in Table 1), treating PHQ items as continuously-scaled. All residual error covariances were fixed to zero. In scaling the factors within a model, we fixed factor variances to 1. Goodness of fit indices are reported below, including the comparative fit index (CFI), Tucker Lewis Index (TLI), root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR). Models fitting very well (or adequately) are indicated by CFI and TLI $\geq$ 0.95 (0.90-0.94), RMSEA $\leq$ .06 (0.07-0.08), SRMR $\leq$ 0.08 (0.90-0.10) (Hu and Bentler, 1999). All tests were two-tailed. Comparing nested models by examining differences in traditional goodness of fit indices (mentioned above) is not appropriate, and inaccurate (Fan and Sivo, 2009). Therefore, in comparing the one-factor model with a given two-factor model, we used a difference test for nested models between Satorra-Bentler chi-square values (with a correction factor because the Satorra-Bentler chi-square value is not distributed normally on a chi-square distribution) (Muthén and Muthén, 2006). We also present Bayesian Information Criterion (BIC) values for comparing the two-factor models with each other; chi-square difference testing is not possible between the two-factor models since they are not nested within one another. In comparing BIC values between models, a 10-point BIC difference represents a 150:1 likelihood and "very strong" ($p < 0.05$) support that the model with the smaller BIC value

fits best; a difference in the 6 to 9 point range indicates "strong" support (Kass and Raftery, 1995; Raftery, 1995).

3. Results

We first estimated descriptive statistics for the PHQ-9 total score. The sample ranged in score from 0 to 27, with a mean of 5.12 ($SD = 6.01$). Thus this sample, as a whole, was represented by only mild depression. Based on the diagnostic scoring algorithm described above and discussed by Kroenke et al. (2001), 282 participants (10.8%) would be classified as a "probable depression" case. Based on a more liberal screening method, using a cutoff score of 10 or higher, 564 participants (21.6%) would be classified as a "probable depression" case.

The one-factor model (Model 1) fit the data reasonably well (see Table 2), as indicated by relatively high estimates on CFI and TLI, and low estimates of RMSEA and SRMR. As demonstrated by chi-square difference testing (implementing the Satorra-Bentler correction factor) each two-factor model fit significantly better than the one-factor model (with uniformly lower chi-square values for the two-factor models); thus the PHQ-9 appeared to be multidimensional rather than unidimensional. Based on BIC values, Model 2b fit significantly better (with a smaller BIC value) than Model 2a, which in turn fit significantly better than Model 2c. Model 2b's superior fit is evidenced by a difference in BIC values of 66 when compared to Model 2a, and a difference of 92 when compared to Model 2c.[1]

Table 3 presents factor loadings for Model 2b, which was the best fitting model. All factor loadings were 0.65 or higher, except for the last loading per factor. Thus for the most part,

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[1] Because CFA results sometimes do not replicate with other samples, we drew a random subsample of ~50% of participants ($n = 1304$) and re-computed the CFA analyses, comparing those results with results computed for the remaining 1311 subjects. We found nearly identical results across subsamples and when compared to the results presented above, with only very minor discrepancies in fit indices. Furthermore, as in the findings presented above, in both randomly generated subsamples all fit indices were strongest for Model 2b.

the items within a given factor hung together very well. The correlation between factors was 0.87.

4. Discussion

We empirically tested four *DSM-IV*-based depression models previously investigated using EFA or CFA in order to reveal the best fitting depression model. Our sample of Army National Guard soldiers was not a severely depressed sample; rather, they were represented as a whole by previously having only mild depression symptoms. As such, our tests of the latent structure of the PHQ-9's depression symptoms essentially modeled depression's components at the mild end of the depression continuum.

We found that using the PHQ-9, the two-factor model supported by Krause et al. (2010) using EFA from their study's second wave of data (17-month) of three longitudinal measurement waves, and by Richardson and Richards (2008), best fit the data. This model is different from the one-factor model previously supported in EFA studies because it separates the general depression factor into somatic and non-somatic factors. It differs from Krause et al.'s model found to fit best in the authors' first of three longitudinal measurement phases because the current model conceptualizes concentration and psychomotor difficulties as part of the somatic factor. The current model differs from Krause et al.'s model discovered from EFA at their study's third measurement wave (29-month follow up) because the current model conceptualizes anhedonia as part of the non-somatic factor.

Each of the two-factor models fit significantly better than the one-factor model. Thus, we find that MDD symptoms (using the PHQ-9) are best represented by somatic and non-somatic factors, rather than a single, unidimensional factor. This distinction between somatic and non-somatic factors is not only an internal distinction within a depression instrument (the PHQ-9),

but likely represents differential relations with other types of psychopathology. For example, Elhai et al. (2011) found that using the Center for Epidemiologic Studies-Depression Scale with Canadian military veterans, depression's somatic items were significantly more related than depression's affective items to particular posttraumatic stress disorder (PTSD) factors. Furthermore, in the present study, the best fitting model (2b) fit better than the other two-factor models, determined by objective statistical criteria. However, because the present study is the first to use CFA with a *DSM-IV*-based depression instrument to test competing depression models, future studies are needed to further examine these, and perhaps other, competing models.

This research is important in contributing to an understanding of the true components of MDD. Future research should further explore the somatic and affective dimensions of MDD and evaluate which of these constructs is more related to depression-related psychopathology as well as treatment outcomes. Understanding these constructs and their correlates can potentially aid clinicians in prioritizing treatment interventions aimed at reducing the more severe subtype of these MDD symptoms. For example, if one subtype of MDD symptoms (for example, somatic items) is found more related to psychopathology, then perhaps that subtype would represent a priority for clinical intervention over other depression symptoms. Furthermore, MDD is similar to, overlaps with, and is comorbid with other mood and anxiety disorders. This feature of MDD will not likely cease with *DSM-5*'s publication, since MDD's proposal for *DSM-5* is quite similar to the *DSM-IV* version, as is the case for other mood and anxiety disorders with which MDD overlaps (American Psychiatric Association. DSM-5 Development., 2010), Future research should attempt to examine the latent structure of MDD in relation to the structure of other mood and anxiety disorders, such as dysthymic disorder, PTSD, and generalized anxiety disorder,

given their conceptual and empirical overlap with MDD (Watson, 2005; 2009). Although recent studies have examined the underlying factors accounting for diagnostic variables marking these disorders (Forbes et al., 2010; Forbes et al., 2011), future work should attempt to analyze this issue with these disorders at the latent construct level (e.g., Elhai et al., 2011).

Several limitations apply to the present study. First, we used the PHQ-9 which is a self-report instrument, albeit administered via telephone format in our study. We do not know the extent to which our findings with a self-report instrument would replicate using a comprehensive, structured diagnostic interview to query MDD, such as the Structured Clinical Interview for *DSM-IV*'s (SCID) depression modules, given the difference in instrument format. Second, our study sampled Army National Guard military personnel (predominantly male), rather than a broader, representative community or clinical sample of men and women. Future work should explore MDD's factor structure using more generalizable civilian and military samples. Third, our sample as a whole reported only mild depression in their lifetimes, and thus we were unable to examine depression's factor structure among a heterogeneous sample varying on current depression severity. Finally, future research should test relationships between MDD factors and specific external constructs of psychopathology.

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Table 1. Factor models tested, and factors on which items were mapped

PHQ 9 Items	Model 1	Model 2a	Model 2b	Model 2c
1. Anhedonia	Depression	Non-Somatic	Non-Somatic	Somatic
2. Depressed mood	Depression	Non-Somatic	Non-Somatic	Non-Somatic
3. Sleep difficulties	Depression	Somatic	Somatic	Somatic
4. Fatigue	Depression	Somatic	Somatic	Somatic
5. Appetite changes	Depression	Somatic	Somatic	Somatic
6. Feeling of worthlessness	Depression	Non-Somatic	Non-Somatic	Non-Somatic
7. Concentration difficulties	Depression	Non-Somatic	Somatic	Somatic
8. Psychomotor agitation/retardation	Depression	Non-Somatic	Somatic	Somatic
9. Thoughts of death	Depression	Non-Somatic	Non-Somatic	Non-Somatic

Note. Model 2a is based on Krause et al.'s (2010) EFA model at baseline measurement and Krause et al.'s (2008) CFA model. Model 2b is based on Krause et al.'s (2010) EFA model at 17 months post-injury, and Richardson and Richards' (2008) model at 1 year post-injury. Model 2c is based on Krause et al.'s (2010) EFA model at 29 months post-injury.

Table 2. Comparison of fit statistics for the four PHQ factor analytic models.

Model	Satorra-Bentler $\chi^2(df)$	CFI	TLI	RMSEA	SRMR	BIC	Compared to Model 1 $\chi^2_{Diff}(df)$
1	317.71(27)*	0.94	0.91	0.06	0.04	56476.07	
2a	246.62(26)*	0.95	0.93	0.06	0.04	56356.37	69.64(1)*
2b	**210.35(26)***	**0.96**	**0.94**	**0.05**	**0.03**	**56290.75**	**101.02(1)***
2c	261.63(26)*	0.95	0.93	0.06	0.04	56382.56	53.87(1)*

Note: CFI = Comparative fit index; TLI = Tucker-Lewis Index; RMSEA = Root mean square error of approximation; SRMR = standardized root mean square residual; BIC = Bayesian information criterion.
* $p < 0.001$.

Table 3. Standardized Factor Loadings for Model 2b.

Factor Loadings	β
Non-somatic	
1. Anhedonia	0.76
2. Depressed mood	0.79
6. Feelings of worthlessness	0.68
9. Thoughts of death	0.48
Somatic	
3. Sleep difficulties	0.68
4. Fatigue	0.71
5. Appetite changes	0.65
7. Concentration difficulties	0.65
8. Psychomotor agitation/retardation	0.50

POSTTRAUMATIC STRESS DISORDER AND HIV RISK BEHAVIOR AMONG ARMY NATIONAL GUARD SOLDIERS: THE MEDIATING ROLE OF DEPRESSION

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ABSTRACT

We examined the relationship between posttraumatic stress disorder (PTSD) and HIV risk behavior among Ohio Army National Guards (OHARNG), and determined whether depression after a traumatic event mediated this association. We analyzed data collected from a sample of OHARNG enlisted between June 2008 and February 2009. Participants completed interviews assessing HIV risk activities as defined by the Behavioral Risk Factor Surveillance System and were screened for PTSD and depression based on DSM-IV criteria. Logistic regression was used to estimate the direct and indirect effects of PTSD on HIV risk behavior. Of 2,282 participants, 147 (6.4%) reported at least one HIV risk behavior. PTSD was associated with HIV risk behavior (adjusted odds ratio [AOR] = 2.1, 95%CI: 1.1–3.9), as was depression (AOR = 2.2, 95%CI: 1.5–3.2). After depression was included as a mediator, the association between PTSD and HIV risk decreased in magnitude (AOR = 1.8, 95%CI: 0.9–3.4), suggesting partial mediation (Sobel test $p<0.01$). Soldiers with PTSD may be at greater risk of HIV infection due to increased engagement in HIV risk behavior. New onset depression following trauma mediates this relationship. Integrated interventions to address mental health problems and reduce HIV risk behavior are in need of development and evaluation.

INTRODUCTION

Posttraumatic stress disorder (PTSD) has long been recognized as a debilitating condition that adversely affects physical and psychological health(Breslau, Davis, Peterson, & Schultz, 1997; Davidson, Hughes, Blazer, & George, 1991; Zatzick et al., 1997).The development of PTSD is associated with a variety of health behaviors (e.g., smoking, alcohol and substance use, physical inactivity, poor utilization of preventive health services) that increase the risk of morbidity and mortality(Breslau, Davis, & Schultz, 2003; Buckley, Mozley, Bedard, Dewulf, & Greif, 2004; Schnurr & Spiro, 1999). A growing body of literature has also shown that persons who develop PTSD following exposure to trauma are more likely to participate in HIV risk behaviors(Brief et al., 2004). For example, a lifetime occurrence of PTSD has been associated with recent engagement in receptive anal intercourse and sex work among women prisoners(Hutton et al., 2001). A study of women who had experienced intimate partner violence (IPV) demonstrated that IPV-related PTSD was significantly associated with a composite measure of sexual risk behavior, and was particularly elevated among women with avoidance and numbing symptoms(Cavanaugh, Hansen, & Sullivan, 2010). Similar results have been reported among women seeking emergency care in New York City(El-Bassel, Gilbert, Vinocur, Chang, & Wu, 2011). Although fewer studies have examined the relationship between PTSD and HIV risk among men, some

evidence indicates that PTSD increases the risk of unprotected anal intercourse in men who have sex with men(Reisner, Mimiaga, Safren, & Mayer, 2009).

Depression is widely reported as a risk factor for sexual- and drug-related HIV risk behavior in the general and at-risk populations(Alegría et al., 1994; Lehrer, Shrier, Gortmaker, & Buka, 2006; Perdue, Hagan, Thiede, & Valleroy, 2003; Williams & Latkin, 2005). Furthermore, HIV risk behaviors are particularly common among persons experiencing co-occurring depression and PTSD(Holmes, Foa, & Sammel, 2005; Plotzker, Metzger, & Holmes, 2007). A number of theories have been proposed to explain the association between co-morbid psychopathology and engagement in HIV risk behavior. A common hypothesis is that participation in drug-related HIV risks is the result of efforts to self-medicate psychiatric symptoms(Chilcoat & Breslau, 1998; Miller, 1999).Some authors have suggested that depression heightens PTSD symptomatology (specifically avoidance and numbing symptoms), which in turn may result in non-intimate serial partnerships, detachment from interest in sexual acts and condom use, and more rapid partner turnover (Cavanaugh, et al., 2010; Plotzker, et al., 2007).Evidence indicating that an individual'shigh-risk practices are heavily influenced by social and structural environments has led to another hypothesisthat certain social and sexual network characteristics (e.g., low level of social support, high burden of psychopathology among network members)are more common among persons with

mental illness(Rhodes, Singer, Bourgois, Friedman, & Strathdee, 2005), and thus act to increase the likelihood that risk behavior will occur(Miller, 1999).

The objective of this study was to determine whether depression and PTSD were associated with increased engagement in HIV risk behavior among a sample of Ohio Army National Guards (OHARNG). We also sought to examine the direct and indirect effects of PTSD on HIV risk behavior, hypothesizing that new onset depression following exposure to a traumatic event mediates this relationship. Given the high prevalence of trauma exposure and subsequent PTSD among National Guard soldiers(Calabrese et al., 2011; Kehle et al., 2011), and the paucity of studies examining whether these conditions increase the risk for HIV infection in this population,elucidating the relationship between mental health problems and HIV risk behavior has important implications for the development of effective HIV prevention services for military personnel.

METHODS

Study Sample and Data Collection

Between December 2008 and November 2009, OHARNGsoldiers were recruited to participate in the OHARNG Mental Health Initiative.This study aims to identifythe risk and resilience factors associated with psychiatricconditions experienced by soldiers of the OHARNG.Recruitment, sampling, and follow-up procedures have been

described previously(Calabrese, et al., 2011).Briefly, all soldiers with a current address (*n* = 12,225) were mailed a letter explaining the study's objectives and consenting procedures along with a pre-paid opt-out card. During the enrolment period, we randomly contacted 4,198 participants of the 6,514 (53.2%) from whom an opt-out card was not received and who had a working telephone number on record. Of those successfully contacted, 1,324 (20.3%) refused to participate, and 218 (3.3%) were excluded for other reasons (i.e., were deceased, did not speak English, had hearing problems, or were retired).Thus, the eligible sample was 2,616.

Computer-assisted telephone interviewing (CATI) was used to collect a wide array of information regarding sociodemographic characteristics, risk behaviors, military history, deployment and combat experiences, and past and presentpsychopathological symptoms. Interviews took approximately 60 minutes to complete andall participants were compensated for their time.

The study received a certificate of confidentiality from the National Institutes of Health, and the study protocol was approved by the Institutional Review Boards of University Hospitals Case Medical Center, University of Toledo, and Columbia University. The study was also approved by the Human Research Protection Office (HRPO), Office of Research Protections (ORP), and the U.S. Army Medical Research & Materiel Command (USAMRMC) of the U.S. Department of Defense.

Measures

Thedependent variable for this analysis was self-reported participation in HIV risk behavior(s) in the past year (yes vs. no). To define this variable, we used a standardized set of core questions from the Behavioral Risk Factor Surveillance System (BRFSS), a U.S. Centers for Disease Control and Prevention (CDC)-supported general population survey that includes measures of HIV/STD risk behaviors(Centers for Disease Control and Prevention, 2011). Core items included in the HIV/AIDS section of the BRFSS were developed by a 1997 CDC working group and were chosen after extensive cognitive laboratory testing and field piloting(Rietmeijer, Lansky, Anderson, & Fichtner, 2001). To assess HIV risk behaviors, participants were asked whether they had engaged in any of the following in the past year: 1) used intravenous drugs, 2) been treated for a sexually transmitted or venereal disease, 3) given or received money or drugs in exchange for sex, and 4) had anal sex without a condom. To be consistent with BRFSS methodology and with previously published studies using this measure(Bensley, Van Eenwyk, & Simmons, 2000; Link, Battaglia, Frankel, Osborn, & Mokdad, 2006; Wen, Balluz, & Town, 2012), participants were informed that they did not have to identify which risk(s) they had practiced in the past year.

The primary independent variable of interest wasa positive screen for PTSD, assessed using the PTSD Checklist – Civilian Version (PCL-C), modified to include questions that assessedDSM-IV diagnostic criteria A2, E, and F(Blake et al., 1995).Thus,

participants screening positive for PTSD must have had to meet all DSM-IV criteria related to a specific traumatic event: been exposed to a criterion A stressor (e.g., a traumatic event involving actual or threatened death or serious injury); had at least one intrusion symptom (e.g., recurrent distressing recollections or dreams of the event);had at least three symptoms of avoidance (e.g., avoiding activities, places, or people associated with the trauma); and had at least two hyperarousal symptoms (e.g., difficulty falling asleep, hyper-vigilance). Symptoms must also have lasted for at least a month and caused significant social or functional impairment. The PCL-C has been found to be a reliable and valid instrument in both general and military personnel populations(Blanchard, Jones-Alexander, Buckley, & Forneris, 1996; Maguen et al., 2010).

The proposed mediator in this analysis was screening positive for a depressive disorder, assessed using the Primary Care Evaluation of Mental Health Disorders Patient Health Questionnaire – 9 (PHQ-9)(Kroenke & Spitzer, 2002; Kroenke, Spitzer, & Williams, 2001). To screen positive for depression, a participant had to score ≥2 of 9 symptoms on the PHQ-9, and these symptoms had to occur together within a 2-week period along with either depressed mood or anhedonia. Although a more conservative cut-off of ≥5 has been used to define major depressive disorder, we used a sensitive measure to screen for any depression, which has been validated and used previously(Calabrese, et al., 2011; Martin, Rief, Klaiberg, & Braehler, 2006).The

following covariates were also assessed as possible confounders: gender (female vs. male); age; marital status (never married, divorced/separated/widowed, married); race (white, black, other);annual income (≤$60,000 vs. >$60,000); education (high school graduate, some college, college/graduate degree); insurance status (non-insured vs. insured);history of alcohol abuse, based on DSM-IV criteria, with onset prior to the PTSD-related traumatic event (yes vs. no);and deployment history (deployed vs. never deployed).

In addition to the PCL-C and PHQ-9, we also asked participants to report the year during which the criterion A traumatic event was experienced and the age of onset of depressive symptoms. In order for the proposed mediator to occur on the causal pathway between the independent and dependent variable, depressive symptoms must have manifested after exposure to the traumatic event. Therefore, we used this timing data to exclude participants who reported having depressive symptoms prior to the date of experiencing the criterion A stressor ($n = 53$). We also excluded participants for whom the timing of onset of these two conditions could not be differentiated ($n = 30$). Finally, we excluded 155 participants who were not eligible for screening positive for PTSD (i.e., had never experienced a qualifying traumatic event) and also excluded 96 due to missing data. Therefore, the final sample was 2,282.

Clinical Interview

In addition to the CATI interviews, we conducted in-person clinical assessments on a random sub-sample of 500 participants. After consent was obtained, clinicians conducted the interviews in a location chosen by the participant. HIV risk behaviors were assessed using the same set of BRFSS questions listed in the telephone survey; however, in addition to the global measure of HIV risk (i.e., reporting one or more risk activities), participants completing the clinical interview were also asked to identify the specific set of behavior(s)in which they had engaged. In order to examine the level of agreement between HIV risk behaviorsreported during the CATI andthose during the in-person interviews, we computed the kappa coefficient for responses from all participants who completed both types of assessments.

The Structured Clinical Interview for DSM-IV Disorders (SCID) was used to conduct detailed psychopathology assessments in the clinical subsample. In the clinical reappraisal, the CATI assessments were found to be reliable and of high specificity(Calabrese, et al., 2011).Clinical interviews typically lasted two hours and participants were reimbursed $50 per hour for their time.

Statistical Analyses

As a first step, we compared the characteristics of persons reporting past year HIV risk behavior with those reporting no risk behavior using Pearson's χ^2 test. We then conducted a mediation analysis following the procedures developed by Baron and

Kenney(Baron & Kenny, 1986). The objective of this analytic procedure is to examine whether a proposed mediator causes variation in a dependent variable, which itself is caused to vary by an independent variable(Last, 2001). To test the meditationalhypothesis, we constructed four separate logistic regression models to determine the relationship between: path *a*, the independent variable (i.e., PTSD) and the proposed mediator (i.e., depression); path *b*, the mediator and dependent variable (i.e., HIV risk behavior); path *c*, the independent variable and dependent variable; and path *c'*, a final regression including both the mediator and independent variable as correlates of the dependent variable. Each model was also adjusted for all other covariates assessed in bivariate analyses. If mediation is present, the magnitude and significance of the coefficient describing the association between PTSD and HIV risk behavior after accounting for the mediator (path *c'*) should be less than that obtained from path *c*. In the situation where the relationship is explained entirely by the mediated pathway, the coefficient derived from *c'*should be equal to zero (i.e., the odds ratio is equal to unity). This is known as full mediation. If the coefficient from *c'* remains greater than zero, partial mediation is present, which indicates that both direct and indirect mechanisms may explain the association between the independent and dependent variables. As a final step, we used the Sobel test to determine the statistical significance of the proposed mediation pathway. This test is used to determine whether the indirect effect of the independent variable on the dependent variable through the

mediated pathway is significantly different from zero(Sobel, 1982).All statistical analyses were conducted in SAS 9.2, and all *p*-values are two-sided.

RESULTS

Sample Characteristics

Of 2,282 participants, the majority were male (86.3%), white (88.3%) and less than 35 years of age (64.8%). The lifetime prevalence of PTSD in the sample was 6.6%. In total, 441 persons (19.3%) screened positive for depression either in the absence of lifetime PTSD or after a PTSD-inducing traumatic event.

Past year HIV risk behavior was reported by 147(6.4%, 95%CI: 5.5% − 7.1%) participants who completed the CATI interview. As shown in Table 1, screening positive for PTSD and depressive disorder were each positively and significantly associated with HIV risk behavior (both *p*< 0.01). Participants reporting HIV risk behavior were also more likely to be female, younger, non-white, single or of divorced/separated/widowed martial status, and of lower annual income.

Mediation Analysis

The results of the mediation analyses are shown in Figure 1. Screening positive for PTSD was found to be significantly associated with depression (path *a*, adjusted odds ratio [AOR] = 3.3, 95%CI: 2.2 − 5.0, *p*< 0.01), after adjustment for other covariates.Depression was found to be positively and independently associated with

engagement in HIV risk behavior (path *b*, AOR = 2.2, 95%CI: 1.5 – 3.2, *p* < 0.01). PTSD

was also found to be associated with HIV risk behavior (path *c*, AOR = 2.1, 95%CI: 1.1 –

3.9, *p* =0.02). However, after controlling for depression, the association between PTSD

and HIV risk behavior decreased in magnitude and became non-significant (path *c'*,

AOR = 1.8, 95%CI: 0.9 – 3.4, *p* = 0.07), indicating partial mediation. The Sobel test

(*p* < 0.01) suggested that the indirect effect of depression on the relationship between

PTSD and HIV risk behavior was significant.

Sensitivity Analysis

To determine whether excluding the 30 participants for whom we could not

differentiate the timing of depression and PTSD may have altered our results, we

conducted a second mediation analysis, assuming that allof these participants had

depressive symptomsfirst occurring after exposure to a PTSD-inducing traumatic event.

The effect on the magnitude of our results was minimal (path *c*, AOR = 2.2, 95%CI: 1.3 –

3.9, *p*< 0.01; path *c'*, AOR = 1.7, 95%CI: 1.0 – 3.1, *p* = 0.06; Sobel test,*p* < 0.01). Randomly

assigning 50% and 25% of these excluded participants tonew onset depression also had

a negligible effect on our results (data not shown).

Clinical Sample Characteristics

Among the subsample of 500 participants who completed the in-person clinical

assessment, HIV risk behavior data was assessed and collected from 310. Of these

participants, 24 (8.1%, 95%CI: 5.1%– 11.1%) reported engaging in at least one HIV risk

behavior. In total, 16 (5.2%) reported unprotected anal intercourse, 9 (2.9%) reportedbeing treated for a sexually transmitted disease, 4 (1.3%) had used intravenous drugs, and nonereported exchanging sex for money or drugs in the past year. Of participants who completed both the CATI and in-person interviews, the level of agreement for reported HIV risk behavior was good ($\kappa = 0.58$, 95%CI: $0.41 - 0.75$).

DISCUSSION

In this study of Ohio Army National Guard, we observed a high prevalence of self-reported participation in HIV risk behavior compared to the general population. Screening positive for PTSD and depression were found to be independent and significant correlates of this outcome. Finally, new onset depression following exposure to a criterion A stressorpartially mediated the association between PTSD and HIV risk behavior in this population.

The prevalence of HIV risk behavior observed in this study (6.4%) is higher than that found in anationally representative sample of US adults conducted in 2005, in which 4.0% reported past year engagement in at least one of the HIV risk behaviors included in the BRFSS(Ohl & Perencevich, 2011).Interestingly, our results are comparable to the prevalence of BRFSS HIV risk behaviors found in other populations with adverse life experiences and exposure to trauma, including for example survivors of childhood abuse (7.6%), intimate partner violence (7.4%), and childhood cancer

(8.3%)(Bensley, et al., 2000; Breiding, Black, & Ryan, 2008; Phillips-Salimi, Lommel, & Andrykowski, 2011). Given that over 90% of the OHARNG cohort has experienced at least one traumatic event(Calabrese, et al., 2011), the comparable prevalence reported here to those observed in these studies is not entirely unexpected. However, it is also likelythat the young and predominately unmarried sociodemographic profile of the cohort resulted in an HIV risk behavior prevalence greater than that observed in general population studies.

Our findings are also consistent with an existing body of literature that has consistently demonstrated PTSD and depression to be positively associated with engagement in HIV risk behavior in non-military populations(Alegría, et al., 1994; Cavanaugh, et al., 2010; Hutton, et al., 2001; Perdue, et al., 2003). Although there is a paucity of research examining the relationship between mental health problems and HIV risk in military personnel, an analysis of data from the 1992 National Survey of Veterans showed that persons with co-morbid PTSD and substance abuse disorders were at a greatly elevated risk of HIV infection(Hoff, Beam-Goulet, & Rosenheck, 1997). One recent study of soldiers in the Dominican Republic also foundthat PTSD was associated with sexual risk behavior(Tavarez, Chun, & Anastario, 2011).

Although the cross-sectional nature of ours and these studies limit inference with respect to the causal relationship between PTSD and HIV risk, these findings suggest that interventions which aim to address psychiatric disorders among military personnel

may have an ancillary benefit of reducing high-risk sex and drug-related behaviors. Irrespective of an underlying causal mechanism, our results indicate that soldiers suffering from PTSD and depression should be the focus of future HIV prevention efforts. Although military-focused HIV prevention interventions have been implemented and are effective at reducing risk behavior in some settings(Bing et al., 2008; Ross et al., 2006; Russak, Ortiz, Galvan, & Bing, 2005), to our knowledge no studies have evaluated the efficacy of HIV prevention programs specifically for military personnel with mental illness. Given the significant burden of mental health problems in this population(Kehle, et al., 2011; Milliken, Auchterlonie, & Hoge, 2007; Thomas et al., 2010), interventions that integrate psychiatric and HIV prevention services warrant development and evaluation.

The finding that depression mediates the relationship between PTSD and HIV risk behavior supports previously identified mechanistic pathways: PTSD increases the risk for new onset depression(Breslau, et al., 1997), which in turn heightens one's propensity to engage in behaviors associated with HIV acquisition(Miller, 1999). However, the incomplete (i.e., partially) mediating effect of depression suggests that PSTD mayalso directly increase the likelihood of engaging in HIV risk behavior. Specific symptomatology associated with PSTD, including for example avoidance, hyperarousal, and feelings of dissociation, are thought to result in a variety of sexual risks(e.g., difficulty negotiating safer sexual behavior, seeking out riskier sexual

encounters) as well as increased drug use and related risk behavior(El-Bassel, et al., 2011; Miller, 1999; Plotzker, et al., 2007).While the majority of prior research has been conducted among women, this study provides some evidence that similar pathwaysmay explain the relationship between PTSD and HIV risk among predominately male populations with a high burden of trauma. Further research is required to elucidate more fully the direct and indirect influences of PTSD on engagement in behaviors associated with HIV acquisition, and whether these relationships are moderated by gender.

A number of important study limitations must be noted. First, the cross-sectional nature of our analysis precludes a causal interpretation of the observed associations.However, we note that our ability to restrict the sample to participants who reported onset of depressive symptoms after a PTSD-inducing traumatic event strengthens the proposed meditational relationships. Second, we were not able to examine more antecedent components of the hypothesized etiologic pathway, including the potentially direct relationship between exposure to trauma and HIV risk behavior in the absence of PTSD. Third, while we note that a small number of participants were unable to recall the precise timing of these conditions and were excluded, a sensitivity analysis demonstrated that the impact of this error on our primary results was negligible. Fourth, our measure of HIV risk was self-reported, and thus may be susceptible to under-reporting, particularly given the stigmatized nature of the assessed

behaviors. While the higher prevalence of HIV risk behavior observed among participants completing the in-person clinical assessment does suggest some under-reporting in the larger CATI sample, the relatively small difference of these values (i.e., 8.1% vs. 6.4%) indicates that the magnitude of potential bias from under-reporting is minimal. Finally, while our results are strictly generalizable to soldiers willing to participate in the research, we note that the characteristics of our sample are similar to those of the OHARNG(Calabrese, et al., 2011), and are thus likely representative of the larger population.

In summary, this study demonstrated that mental health problems, notably PTSD and depression, were prevalent and associated with increased engagement in HIV risk behaviors among a sample of Ohio Army National Guard. The partially mediating effect of depression indicates a direct and indirect role of PTSD on augmenting vulnerability to HIV in this population. Given the expanding role of National Guard in combat operations and the commensurate increase in exposure to traumatic events, effective interventions are required to support soldiers at risk for HIV and prevent future infections.

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TABLE 1. Factors associated with reporting past year HIV risk behavior[¶] among a sample of Ohio Army National Guard.

Characteristic	Total (%)* (N = 2282)	HIV risk behavior[¶]		P -value
		Yes (%) (N = 147)	No (%) (N = 2135)	
Posttraumatic Stress Disorder (PTSD)[†]				
Yes	142 (6.2)	20 (14.1)	122 (85.9)	<0.01
No	2140 (93.8)	127 (5.9)	2013 (94.1)	
Depressive Disorder[‡]				
Yes	441 (19.3)	49 (11.1)	392 (88.9)	<0.01
No	1841 (80.7)	98 (5.3)	1743 (94.7)	
Sex				
Women	312 (13.7)	30 (9.6)	282 (90.4)	0.01
Men	1970 (86.3)	117 (5.9)	1853 (94.1)	
Age (years)				
17-24	720 (31.6)	70 (9.7)	650 (90.3)	<0.01
25-34	757 (33.2)	49 (6.5)	708 (93.5)	
35-44	576 (25.2)	24 (4.2)	552 (95.8)	
≥ 45	229 (10.0)	4 (1.8)	225 (98.3)	
Marital status				
Married	1122 (49.2)	40 (3.6)	1082 (96.4)	<0.01
Divorced/separated/widowed	219 (9.6)	16 (7.3)	203 (92.7)	
Never married	941 (41.2)	91 (9.7)	850 (90.3)	
Race				
White	2015 (88.3)	121 (6.0)	1894 (94.0)	0.03
Black	162 (7.1)	18 (11.1)	144 (88.9)	
Other	105 (4.6)	8 (7.6)	97 (92.4)	
Income				
≤ $60,000	1329 (58.2)	102 (7.7)	1227 (92.3)	<0.01
> $60,000	953 (41.8)	45 (4.7)	908 (95.3)	
Education				
High school graduate	610 (26.7)	43 (7.1)	567 (93.0)	0.26
Some college	1076 (47.2)	74 (6.9)	1002 (93.1)	
College/graduate degree	596 (26.1)	30 (5.0)	566 (95.0)	
History of alcohol abuse[§]				
Yes	34 (1.5)	7 (20.6)	27 (79.4)	<0.01
No	2248 (98.5)	140 (6.2)	2108 (93.8)	

TABLE 1. Factors associated with reporting past year HIV risk behavior[¶] among a sample of Ohio Army National Guard.

Characteristic	Total (%)* (N = 2282)	HIV risk behavior[¶]		P -value
		Yes (%) (N = 147)	No (%) (N = 2135)	
Insurance Status				
Non-insured	252 (11.0)	21 (8.3)	231 (91.7)	0.19
Insured	2030 (89.0)	126 (6.2)	1904 (93.8)	
Deployment History				
Deployed	764 (33.5)	58 (7.6)	706 (92.4)	0.11
Never deployed	1518 (66.5)	89 (5.9)	1429 (94.1)	

Notes: ¶ Defined as an affirmative response to at least one of the following: (in the past year, have you) used intravenous drugs; been treated for a sexually transmitted or venereal disease; given or received money or drugs in the exchange for sex; or had anal sex without a condom. † Ever in lifetime. ‡ Restricted to cases occurring after a PTSD-related traumatic event (individuals with depressive symptoms preceding PTSD-related trauma were excluded). § Only consider as "yes" those with onset prior to PTSD-related traumatic event.

FIGURE 1: **Mediation analysis demonstrating the direct and indirect effect of posttraumatic stress disorder (PTSD) on self-reported past year HIV risk behavior in a sample of Ohio National Guard (*n* = 2282).**
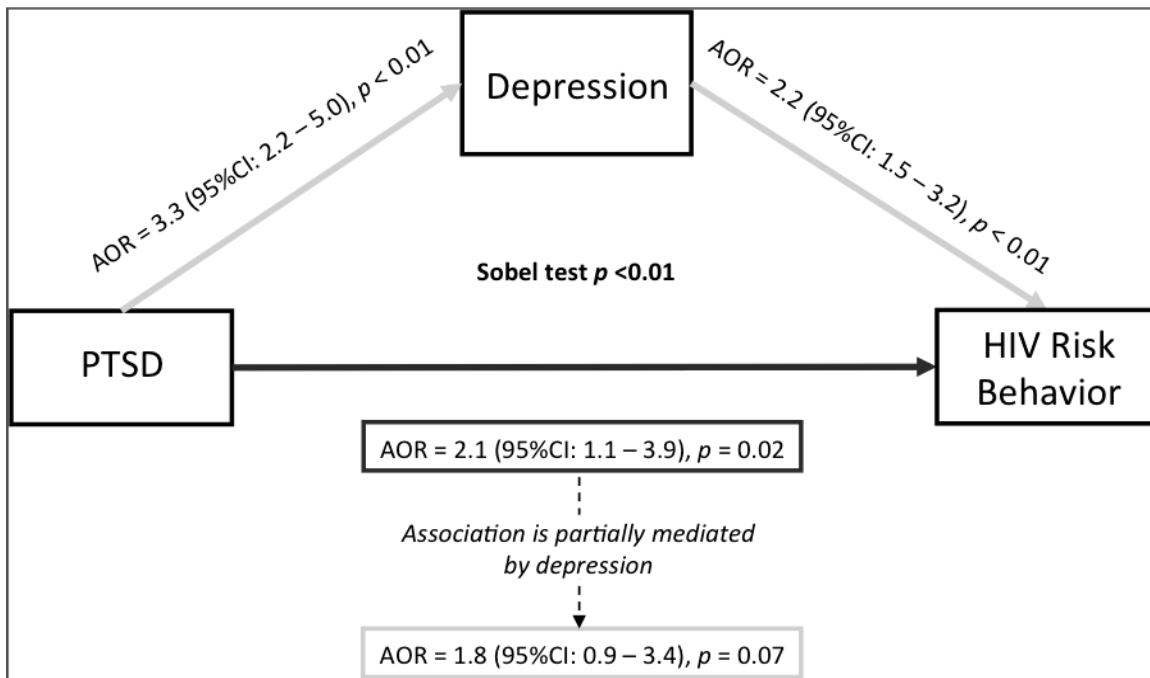
Note: HIV risk behavior includes a positive response to any of the following: (in the past year, have you) used intravenous drugs; been treated for a sexually transmitted or venereal disease; given or received money or drugs in the exchange for sex; had anal sex without a condom.

Note: Self-reported data on the timing of traumatic events and the onset of depressive symptoms were used to ensure that PTSD preceded depression. Individuals who first experienced depressive symptoms prior to experiencing a PTSD-related traumatic event were excluded from the sample.

Note: all regression models adjusted for sex, age, martial status, race, income, education, deployment history, and health insurance status.

Running head: DIMENSIONS OF PTSD AND MAJOR DEPRESSION

Relations Between the Underlying Dimensions of PTSD and Major Depression Using an

Epidemiological Survey of Deployed Ohio National Guard Soldiers

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Abstract

In the present study, the authors investigated the relationship between the underlying symptom dimensions of posttraumatic stress disorder (PTSD) and dimensions of major depressive disorder (MDD). A sample of 1,266 Ohio National Guard soldiers with a history of overseas deployment participated and were administered the PTSD Checklist (assessing PTSD) and Patient Health Questionnaire-9 (assessing depression). Using confirmatory factor analysis, results demonstrated that both PTSD's dysphoria and hyperarousal factors were more related to depression's somatic than non-somatic factor; however, PTSD's dysphoria was more related to somatic depression than PTSD's hyperarousal factor. Given PTSD's substantial dysphoria/distress component these results have implications for understanding the nature of PTSD's high comorbidity with depression.

Keywords: posttraumatic stress disorder, major depressive disorder, factor analysis, military veterans, comorbidity

Relations Between the Underlying Dimensions of PTSD and Major Depression Using an

Epidemiological Survey of Deployed Ohio National Guard Soldiers

There are substantial rates of comorbidity between posttraumatic stress disorder (PTSD) and major depression. For example, the National Comorbidity Survey found that 48.0 – 55.0% of individuals diagnosed with PTSD were also diagnosed with major depression in their lifetimes (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). While the comorbidity of PTSD and depression is well established (Elhai, Carvalho, et al., 2011; Keane & Kaloupek, 1997), very little data have been collected regarding which of the underlying dimensions of PTSD and depression are most related to each other.

Several hypotheses have been proposed to explain the significant comorbidity between PTSD and major depressive disorder. We focus on two hypotheses in particular. First, several symptoms overlap between *DSM-IV* major depressive disorder (MDD) and PTSD (i.e., difficulties with sleep, concentration and anhedonia). As a consequence, satisfying criteria for one of these two disorders places an individual at substantial risk of being diagnosed with the other disorder merely by virtue of these overlapping symptoms (Spitzer, First, & Wakefield, 2007). Second, there may be a shared underlying latent mechanism behind depression and PTSD. Watson (2005) proposed that mood and anxiety disorders are defined by a higher order negative affect factor which subsumes a broad range of negative emotional states including fear, anger, and sadness. Watson argued that this higher order factor accounts for the high rates of comorbidity among mood and anxiety disorders, such as major depression and PTSD.

Recently, researchers have investigated the overlapping symptoms hypothesis of PTSD's comorbidity. Spitzer, First and Wakefield (2007) suggested that removing the overlapping PTSD-depression items should result in a more pure, less comorbid PTSD diagnostic construct.

However, a study by Elhai et al. (2008) found instead that removing overlapping items had negligible effects on PTSD's comorbidity rates (after removing overlapping items, comorbidity rates dropped nominally from 54.72% to 54.41% in the National Comorbidity Survey Replication dataset). Similar results were found in a study of military veterans by Grubaugh, Long, Elhai, Frueh, and Magruder (2010) and a study of nationally representative, trauma-exposed adolescents conducted by Ford, Elhai, Ruggiero, and Frueh (2009). The shared mechanism hypothesis has been investigated as well, by examining PTSD's robust, empirically-supported latent factor of dysphoria that is conceptually similar to the general negative affect construct (Simms, Watson, & Doebbeling, 2002); we discuss the dysphoria construct more extensively below.

Factor analysis is a relatively under-utilized approach to examining issues of comorbidity between mental disorders. The use of factor analysis can help to elucidate the nature of comorbidity by examining which underlying factors of a disorder are more highly correlated with factors of another similar mental disorder. This method can be used to test the construct validity of a disorder (e.g., its uniqueness as a disorder) in a more refined manner than by examining comorbidity between crudely measured, observed diagnostic variables. Furthermore, this research is particularly timely given that a new edition of the *Diagnostic and Statistical Manual (DSM)* is currently being developed.

PTSD's Factor Structure

There are two models of underlying PTSD symptoms that have received substantial empirical support. One model proposed by King, Leskin, King, and Weathers (1998) comprises the following four intercorrelated factors: Re-experiencing, effortful avoidance, emotional numbing, and hyperarousal. This model is essentially identical to *DSM-IV*'s conceptualization of

PTSD except that the avoidance and numbing symptom cluster (PTSD's Criterion C) is separated into distinct avoidance and numbing factors, supported by empirical research (reviewed by Asmundson, Stapleton, & Taylor, 2004). The other empirically supported PTSD model is the dysphoria model proposed by Simms et al. (2002), comprising the following four intercorrelated factors: Re-experiencing, avoidance, dysphoria, and hyperarousal. In this model, the numbing items are combined with three hyperarousal items (difficulties with sleep, concentration and irritability) to form a dysphoria factor which involves symptoms of emotional distress common to mood and anxiety disorders (reviewed in Watson, 2005). Both models have been extensively studied using confirmatory factor analysis (CFA), demonstrating good fit among different trauma exposed samples and using a variety of PTSD instruments (reviewed in Elhai & Palmieri, 2011; Yufik & Simms, 2010).

Depression's Factor Structure

There is less research regarding the factor structure of major depressive disorder, and the resulting factor structure often differs depending on which depression instrument was used to assess depressive symptoms. In the present study, the Patient Health Questionnaire-9 (PHQ-9) was used to examine depression's factor structure. The PHQ-9 is a widely used self-report measure of depression and maps directly onto the *DSM-IV* symptom criteria for a major depressive episode (MDE) (Kroenke, Spitzer, & Williams, 2001). Although the PHQ-9 has been empirically well-researched, few studies have analyzed its factor structure. Prior studies have used exploratory factor analyses (EFA) (Cameron, Crawford, Lawton, & Reid, 2008; Dum, Pickren, Sobell, & Sobell, 2008; Huang, Chung, Kroenke, Delucchi, & Spitzer, 2006; Kalpakjian et al., 2009; Krause, Reed, & McArdle, 2010) and CFA (Baas et al., 2011; Krause, Bombardier, & Carter, 2008) to assess the PHQ-9's symptom structure. Most PHQ-9 factor analytic studies

either support a unidimensional depression model (Baas et al., 2011; Cameron et al., 2008; Dum et al., 2008; Kalpakjian et al., 2009) or a two-factor model (Krause et al., 2008; Krause et al., 2010; Richardson & Richards, 2008).

The only study, to our knowledge, that has empirically tested the several PHQ-9 depression factor models simultaneously with objective statistical criteria using CFA was a study conducted by Elhai, Contractor, Tamburrino Fine, Prescott, Shirley, et al. (2012). Overall, these studies have found the most support for a two-factor model, with one factor comprising five somatic items (sleep changes, appetite disturbances and feeling tired, difficulty concentrating and psychomotor changes) and the other factor primarily based on four non-somatic or affective items (anhedonia, depressed mood, suicidal thoughts, and feeling bad about oneself) (Elhai et al., 2012; Krause et al., 2010; Richardson & Richards, 2008).

Relationship Between the Factor Structure of Depression and PTSD

Despite PTSD's high comorbidity with major depressive disorder, lacking in the literature is a more refined analysis of the PTSD-depression relationship by exploring relations between the latent factors of PTSD and major depressive disorder. In only one recent study, evidence was demonstrated that PTSD's dysphoria factor was strongly related to the Center for Epidemiologic Studies-Depression Scale's (CES-D) factors of somatic problems and negative affect, indicating the shared variance between the two comorbid disorders may be best accounted for by the dysphoric symptoms present in the PTSD diagnosis(Elhai, Contractor, Palmieri, Forbes, & Richardson, 2011). Specifically, this study found that the dysphoria factor demonstrated a strong relationship with the CES-D's depressive affect ($r = .77$) and somatic problems ($r = .84$). PTSD's dysphoria was also found to correlate most strongly with depression's somatic problems factor relative to the remaining three factors of the CES-D.

Although this study provides a better understanding of the relationship between the latent factors of PTSD and MDD, the CES-D is a 20-item depression instrument that does not directly map onto *DSM-IV*'s major depressive disorder criteria. Therefore, it is unknown whether those study results are generalizable to a *DSM-IV* major depression-based instrument that would be more likely used to support a MDD diagnosis.

Study Aims

The purpose of the current study was to further examine the relationship between the latent factors of PTSD and depression in a sample of war-exposed military veterans. The Simms et al. (2002) dysphoria model was used to model PTSD symptoms given that this model comprises a general negative affect component which is conceptually similar to depression. Krause et al.'s (2008) two-factor depression model of somatic and non-somatic factors was used to analyze the depression factor structure, given that this model has received the most empirical support(Elhai, Contractor, et al., 2011). We used the PTSD Checklist (PCL) to measure PTSD symptoms, and the PHQ-9 to measure major depression symptoms.

We were interested in testing if the dysphoria and hyperarousal factors of PTSD were more related to depression's somatic vs. non-somatic factor. Four specific hypotheses were tested in particular. The first hypothesis was that PTSD's dysphoria factor would correlate most strongly with depression's somatic than non-somatic factor. The dysphoria factor comprises both somatic items and non-somatic items (e.g., difficulty concentrating, feeling emotionally numb), but it was hypothesized that it would correlate more strongly with the somatic factor of depression given that a previous study found that PTSD's dysphoria correlated more strongly with depression's somatic complaints factor (Elhai, Contractor, et al., 2011). The second hypothesis was that the two-item PTSD hyperarousal factor (i.e., exaggerated startle response,

hypervigilance) would correlate more strongly with major depressive disorder's somatic than non-somatic factor given that these items are somatic in nature. However, in Hypothesis 3, we expected that depression's somatic factor would be more strongly correlated with PTSD's dysphoria factor than with the hyperarousal factor given that the dysphoria factor contains more somatic-related items (D1-D3). Finally, as our fourth hypothesis, we expected that neither reexperiencing nor avoidance factors of PTSD would be differentially related to the somatic or non-somatic factors of depression, given the lack of conceptual similarities between these constructs.

Method

Participants and Procedure

The present study was part of the Ohio Army National Guard Mental Health Initiative (OHARNG MHI), a longitudinal prospective study of mental health among National Guard soldiers in Ohio. All members of the Ohio National Guard who served between July 2008 and February 2009 were invited to participate in the telephone interview portion of the study. There were 12,225 Guard members with a valid mailing address who were invited to participate (345 individuals were excluded for having no mailing address). Among the pool of potential subjects, 1,013 (8.3%) declined to participate, 1,130 (10.1%) did not have a telephone number listed with the Guard, and 3,568 (31.8%) did not have a correct or working phone number. Among the remaining 6,514 Guard members (58.1%), the following individuals were excluded: 187 (2.8%) based on age eligibility restrictions, 1,364 (20.9%) declined to participate, 31 (.4%) for having English language or hearing difficulties, and 2,316 (35.5%) for not being contacted before the cohort was closed to new recruitment. Of the remaining 2,616 subjects, one subject was excluded for missing as many as six items on the PHQ-9, leaving 2,615 participants. Finally, we only

included participants who reported being deployed and further reported a deployment related

trauma, leaving an effective dataset of 1,266.

Study enrollment began in November 2008 and ended in November 2009. The National

Guard Bureau, Office of Human Research Protections of the U.S. Army Medical Research and

Materiel Command, along with the institutional review boards of University Hospitals Case

Medical Center, University of Toledo, and Columbia University, approved the study with written

informed consent waived in lieu of verbal consent by telephone.

Among the 1,266 remaining subjects, the average age of participants was 33 years ($SD =$

8.81) and ranged from 18 to 60 years. The majority of participants were male ($n = 1144$, 90.4%)

and identified their racial background as primarily Caucasian ($n = 1127$, 89.0%) or African-

American ($n = 81$, 6.4%). Only 16 participants identified themselves as Hispanic (1.3%). The

majority of participants had at a minimum received a high school diploma or its equivalent ($n =$

1260, 99.5%). Many had attended some college or technical training ($n = 636$, 50.2%) or

graduated from college ($n = 243$, 19.2%). There were 873 participants working full-time

(69.0%), 103 participants working part-time (8.1%), 185 who were unemployed (14.6%), and 80

who were of a student status (6.3%). There were 333 participants (26.3%) who had a household

income greater than $80,000. Household income of $20,000 or less was reported by 84

participants (6.6%), between $20,001 and $40,000 by 276 respondents (21.8%), between

$40,001 and $60,000 by 311 participants (24.6%), and between $60,001 and $80,000 by 236

(18.6%). The average length of time participants served in the military was 12.7 years ($SD =$

7.81). All participants had deployed at least once, with the average number of deployments being

2.02 ($SD = 1.76$). For the majority of participants ($n = 742$, 58.6%) the most recent deployment

was in support of Operation Iraqi Freedom (OIF) or Operation Enduring Freedom (OEF). There

were 503 (39.7%) who most recently deployed to an area of non-conflict.

The most prevalent traumatic events experienced by participants were exposure to

combat ($n = 999$, 78.9%), sudden and unexpected death of a loved one or close friend ($n = 874$,

69.0%), witnessing someone being killed or injured ($n = 968$, 55.1%), and witnessing severe

human suffering ($n = 598$, 47.2%). There were 240 participants (19.0%) who reported that

receiving incoming hostile fire was their worst deployment related trauma. The other most

frequently nominated worst deployment-related traumas included experiencing combat or

exposure to a war zone ($n = 87$, 6.9%), and experiencing a sudden death of a close friend or

loved one ($n = 69$, 5.5%).

Instrumentation

A computer-assisted telephone interview (CATI) was conducted for all participants by

trained professionals at the survey research firm Abt SRBI, Inc., to assess demographic

characteristics and mental health functioning using standardized questionnaires.

PHQ-9. Participants completed the PHQ-9 (Spitzer et al., 1994). Traditionally, the PHQ-

9 measures depression symptoms over the previous two weeks based on *DSM-IV* major

depressive episode symptom criteria, but for this study, the instructions were modified in order to

query depression symptoms over the course of the respondent's lifetime, as done by Cannon et

al. (2007). The PHQ-9 uses a Likert-type scale with four response options ranging from 0 =

"Not at all" to 3 = *"Nearly every day"* to assess symptom severity. A study by Kroenke et al.

(2001) examined the validity of using the PHQ-9 to detect and assess for depression, and found

that internal consistency ranged from .86 to .89. Diagnostic validity was demonstrated in

detecting an MDD diagnosis based on structured diagnostic interviews. Lastly, construct validity

was reflected in the association of PHQ-9 severity scores and measures of functional status, number of disability days and difficulties based on symptoms (Kroenke et al., 2001).

PCL-C. Participants also completed the PTSD Checklist – Civilian Version (PCL-C). The PCL-C was adapted so that participants were asked to anchor their PTSD ratings to one's self nominated worst deployment trauma. The PCL is a self-report measure which maps onto the *DSM-IV* symptom criteria for PTSD. There are 17 symptoms assessed by the PCL, and respondents indicate how distressed they were by each symptom over the past month by rating items on a five-point Likert-type scale (1 = "*not at all*" to 5 = "*extremely*"); however, in our study we assessed lifetime symptoms. The PCL has demonstrated adequate reliability (α = .94; test-retest *r* = .88) in various trauma-exposed populations (Ruggiero, Del Ben, Scotti, & Rabalais, 2003), and total scores were found to highly correlate (*r* range = .8-.9) with those from structured PTSD diagnostic interviews in military veterans (Forbes, Creamer, & Biddle, 2001). The psychometric properties of the PCL are reviewed in articles by McDonald and Calhoun (2010) and Wilkins, Lang, and Norman (2011).

Analysis

There were nominal amounts of missing items from the PCL and PHQ measures. There were 1,243 complete cases (98.2%) for the PCL and 1,240 complete cases from the PHQ (97.9%). Missing data were estimated with multiple imputation procedures using an iterative Markov chain Monte Carlo method with the Gibbs Sampler procedure (in SPSS's Version 17 Missing Value Analysis software) to estimate missing item-level PCL and PHQ data, generated across 10 imputed datasets.

The data were screened for univariate and multivariate non-normality. There were several PCL and PHQ items with skewness and kurtosis values greater than 2.0, which indicated a non-

normal univariate distribution. Further, Mardia's multivariate skewness and kurtosis tests indicated a non-normal multivariate distribution ($ps < .001$).

All CFA analyses were conducted using Mplus 6.1 software, averaging parameter estimates across the 10 imputed datasets. Error covariances were fixed to zero, and factor variances were fixed to 1 to scale the factors within a model. All tests were two-tailed, with alpha set at .05. Goodness of fit indices are reported below, including the comparative fit index (CFI), Tucker Lewis Index (TLI), root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR). Models fitting very well (or adequately) are indicated by CFI and TLI $\geq$ .95 (.90-.94), RMSEA $\leq$ .06 (.07-.08), SRMR $\leq$ .08 (.09-.10) (Hu & Bentler, 1999).

CFA analyses for the PCL were conducted using maximum likelihood estimation with a mean-adjusted chi-square (MLM) (the Satorra-Bentler chi-square value), which is robust to non-normality (Satorra & Bentler, 2001). In the first CFA, we examined PTSD's dysphoria model, with PCL items 1-5 specified to load onto the reexperiencing factor, PCL items 6-7 on the avoidance factor, PCL items 8-15 on the dysphoria factor, and PCL items 16-17 on the hyperarousal factor. The PCL items were treated as continuously scaled items. Next, Krause's depression model was examined using the PHQ items. PHQ items 1, 2, 6, and 9 were specified to load onto the non-somatic factor, and PHQ items 3, 4, 5, 7, and 8 on the somatic factor. The PHQ items were also treated as continuously scaled items, using MLM estimation. A CFA was then conducted to examine the combined PTSD dysphoria and depression model, with all factors allowed to correlate.

Wald's chi-square test of parameter constraints was used, which tests the null hypothesis that the difference between two correlations would be zero; we used an alpha level of .01 to

control for Type I error. These analyses were conducted to determine if specific PTSD dysphoria model factors were more highly correlated with either the non-somatic or somatic factors of the depression model. Specifically, we tested whether the PTSD's dysphoria factor was more related to depression's somatic than non-somatic factor (Hypothesis 1). Likewise, we next tested whether the PTSD's hyperarousal factor was more related to depression's somatic than non-somatic factor (Hypothesis 2). Additionally, we tested whether depression's somatic factor would be more related to PTSD's dysphoria than hyperarousal factor (Hypothesis 3). Furthermore, we tested whether PTSD's reexperiencing and avoidance factors (separately) were differentially related to depression's somatic vs. non-somatic factors (Hypothesis 4).

Results

The average PHQ total score among participants was 5.85 ($SD = 6.18$), and the average PCL score was 29.86 ($SD = 14.60$). A cutoff score of 50 in military veterans best discriminates between those with and without PTSD (McDonald & Calhoun, 2010). Kroenke et al. (2001) reported that PHQ-9 scores greater than 10 result in a sensitivity of 88% and specificity of 88% for detecting major depressive disorder.

CFA results from the PTSD dysphoria model indicate that the model fit well, S–B χ^2(113, $N = 1266$) = 569.53, $p < .001$, CFI = .95, TLI = .93, RMSEA = .06, SRMR = .03. Similar well-fitting results were obtained from Krause's 2-factor depression model, χ^2(26) = 131.93, $p < .001$, CFI = .95, TLI = .94, RMSEA = .06, SRMR = .04. The 6-factor combined model also fit the data well, χ^2(284, $N = 1266$) = 1115.407, $p < .001$, CFI = .93, TLI = .93, RMSEA = .05, SRMR = .04.

Wald's tests of parameter constraints were conducted in order to test our hypotheses regarding the differential relationship between the somatic and non-somatic factors of depression with the four PTSD factors. Results indicated that PTSD's dysphoria factor was more strongly

correlated with depression's somatic factor ($r = .69$) than with the non-somatic factor ($r = .59$), $\chi^2(1) = 3.323$, $p < .048$, as expected (Hypothesis 1). PTSD's hyperarousal factor was also more correlated with depression's somatic factor ($r = .51$) than with the non-somatic factor ($r = .34$), $\chi^2(1) = 21.731$, $p < .001$ (Hypothesis 2).

Next, to assess Hypothesis 3, we assessed whether depression's somatic factor was more related to PTSD's dysphoria than hyperarousal factor. Results indicated that the depression somatic factor was more strongly correlated with PTSD's dysphoria ($r = .69$) than with hyperarousal ($r = .51$), $\chi^2(1) = 64.482$, $p < .001$.
 (See Table 2).

Unexpectedly, in contrast to Hypothesis 4, the PTSD's avoidance factor was more strongly correlated with depression's somatic factor ($r = .54$) than to the non-somatic factor ($r = .425$), $\chi^2(1) = 6.502$, $p < .011$.

Discussion

The purpose of this study was to clarify the nature of the comorbid relationship between depression and PTSD by examining the relationships between one disorder's latent factors with those of the other disorder's latent factors. It was hypothesized that PTSD's dysphoria factor would be more related to depression's somatic than non-somatic factor (Hypothesis 1), and that PTSD's hyperarousal factor would correlate more strongly with depression's somatic than non-somatic factor (Hypothesis 2). Further, it was hypothesized that depression's somatic factor would be more related to PTSD's dysphoria than hyperarousal factor (Hypothesis 3), and that PTSD's reexperiencing and avoidance would not be differentially related to depression's somatic or non-somatic factors (Hypothesis 4). Results confirmed that the PTSD's dysphoria factor was more related to somatic aspects of major depressive disorder. As hypothesized, PTSD's

hyperarousal factor was also more strongly correlated with the depression's somatic than non-somatic factor. However, hyperarousal was not as strongly correlated with the somatic factor as dysphoria was.

Previous research has found mixed support for the notion that PTSD's dysphoria is especially related to depression and general emotional distress. While some studies (Elklit, Armour, & Shevlin, 2010; Forbes et al., 2010; Simms et al., 2002) have found that PTSD's dysphoria is uniquely related to emotional distress, other studies have failed to replicate that finding (Marshall, Schell, & Miles, 2010; Miller et al., 2010). The present study clarifies these findings by more precisely analyzing depression not as a crude single variable but rather by analyzing its underlying factors. Thus perhaps mixed findings for dysphoria's external relationships resulted because depression and/or general emotional distress were analyzed as global external variables.

Rather, based on our findings, analyzing depression based on its subcomponents, we find that PTSD's dysphoria is related to depression specifically by way of depression's somatic construct. Our findings corroborate those of a recent factor analytic study which examined the combined symptom structure of PTSD and depression symptoms. In that paper, Elhai et al. also found that PTSD's dysphoria factor was more related to somatic symptoms of depression (Elhai, Contractor, et al., 2011). It is possible that the shared somatic components to both PTSD and depression could account for the comorbidity between depression and PTSD. Perhaps PTSD is so highly comorbid with major depressive disorder because of the shared somatic component between these disorders.

It should be noted that PTSD's dysphoria factor shares two symptoms with the PHQ-9's somatic factor (sleep and concentration difficulties), which could account for its substantial

relationship. However, the dysphoria factor has several other symptoms that are not shared by the somatic factor. Furthermore, research demonstrates that symptom overlap between PTSD and major depressive disorder is not solely responsible for the high rates of comorbidity between these two disorders (Elhai et al., 2008; Ford et al., 2009; Grubaugh et al., 2010).

The hypothesis that the somatic and non-somatic factors of depression would not be differentially related to either PTSD's reexperiencing or avoidance factors was not supported. Specifically, results indicated that depression's somatic factor was significantly more correlated with avoidance than the non-somatic factor was. It may be that individuals who use avoidance as a coping mechanism exhibit more somatic signs of distress (Morina, Ford, Risch, Morina, & Stangier, 2010). Avoidance in fact is considered a maladaptive emotion regulation strategy that leads to an increase in PTSD symptoms – especially physiological (somatic) manifestations of fear (Foa & Kozak, 1986).

Limitations of this study include using self-report instruments (in particular, by telephone) to assess PTSD and depression severity. Thus the limitations that are inherent in using self-report measures apply to this study, including potential problems with response validity, social desirability, memory recall, etc. Additionally, most respondents were men, and thus women were underrepresented. Furthermore, we assessed lifetime symptoms of depression and PTSD and thus we cannot generalize these findings to current assessment of PTSD and depression. Also, the relatively low mean scores on the PHQ-9 and PCL indicate relatively modest MDD and PTSD severity among respondents. Thus, the results of this study may not generalize to a sample of patients with more severe depression and PTSD. Finally, results may not generalize to civilian trauma-exposed samples. Future studies should test these research

questions using structured diagnostic interviews. Future studies should also attempt to use a more

diverse sample exposed to a wider range of traumatic events.

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Table 1. Correlations between Somatic and Non-somatic factors with PTSD factors.

Correlation Between Factors	*r* value	Wald Chi-Square
Reexperiencing and Somatic	$r = .544$	$\chi^2 (1) = 3.306, p = .069$
Reexperiencing and Non-somatic	$r = .459$	
Avoidance and Somatic	$r = .537$	$\chi^2 (1) = 6.502, p = .011$
Avoidance and Non-somatic	$r = .425$	
Dysphoria and Somatic	$r = .689$	$\chi^2 (1) = 3.323, p = .048$
Dysphoria and Non-somatic	$r = .592$	
Hyperarousal and Somatic	$r = .505$	$\chi^2 (1) = 21.731, p < .001$
Hyperarousal and Non-somatic	$r = .337$	

Table 2. Correlations for the Somatic factor with Dysphoria and Avoidance.

Correlation Between Factors	*r* value	Wald Chi-Square
Somatic and Dysphoria	$r = .689$	$\chi^2 (1) = 64.482, p < .001$
Somatic and Avoidance	$r = .537$	
Somatic and Dysphoria	$r = .689$	$\chi^2 (1) = 53.330, p < .001$
Somatic and Hyperarousal	$r = .505$	

Table 3. Correlations Among PTSD and Depression Factors.

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Factor	1	2	3	4	5	6
1. Reexperiencing	-					
2. Avoidance	.898	-				
3. Dysphoria	.846	.837	-			
4. Hyperarousal	.772	.717	.740	-		
5. Somatic	.544	.537	.689	.505	-	
6. Non-Somatic	.459	.425	.592	.337	.862	-

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Prevalence of psychopathology and validation of lay-administered mental health assessments in a large National Guard cohort

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Running title: Prevalence of psychopathology and validation of lay-administered mental health assessments in a large National Guard cohort

Abstract

Purpose: To report the reliability and validity of key mental health assessments in an ongoing study of the Ohio Army National Guard (OHARNG).

Methods: 2616 OHARNG soldiers received hour-long structured telephone surveys including the Posttraumatic Stress Disorder (PTSD) Checklist (PCL-C) and Patient Health Questionnaire – 9 (PHQ-9). A subset (N=500) participated in 2 hour clinical reappraisals, using the Clinician-Administered PTSD Scale (CAPS) and the Structured Clinical Interview for DSM (SCID).

Results: The most commonly reported lifetime conditions were: alcohol abuse 24%, alcohol dependence 23.5%, any depressive disorder 21.4%, and PTSD 9.6%. The telephone survey assessment for PTSD and for any depressive disorder were both highly specific [92% (SE 0.01), 83% (SE 0.02)] with moderate sensitivity [54% (SE 0.09), 51% (SE 0.05)]. Other psychopathologies assessed included alcohol abuse [sensitivity 40%, (SE 0.04) and specificity 80% (SE 0.02)] and alcohol dependence [sensitivity, 60% (SE 0.05) and specificity 81% (SE 0.02)].

Conclusion: The baseline prevalence estimates from the telephone study suggest alcohol abuse and dependence may be higher in this sample than the general population. Validity and reliability statistics suggest specific, but moderately sensitive instruments.

Key Words: military, assessment, "posttraumatic stress disorder", "depressive disorders", "alcohol use disorders"
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Introduction

The link between combat exposure and psychopathologies, including posttraumatic stress disorder (PTSD), depression, anxiety, and substance abuse, among military populations is well documented (Johnson *et al.*, 2009; Killgore *et al.*, 2006). Studies suggest that between 4.8-18% of military populations have had PTSD at some point in their lifetimes (Dohrenwend *et al.*, 2006; Hoge *et al.*, 2004; Iversen *et al.*, 2009; Vasterling *et al.*, 2006) compared with a 6.8-9.2% lifetime prevalence of PTSD for the general United States population (Breslau *et al.*, 1998; Kessler *et al.*, 2005a). Similarly, studies suggest that military personnel have a greater lifetime prevalence of depression and generalized anxiety compared with the general population (Hoge *et al.*, 2004; Kulka, 1990).

During Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) the National Guard and Reserve forces were deployed to combat zones at an unprecedented level (Vogt *et al.*, 2008) and in 2007 comprised approximately 27% of the total troops deployed in Operation Iraqi Freedom (OIF) and in Operation Enduring Freedom (OEF)(Sollinger *et al.*, 2008). Little is understood about the long-term effects of deployment on National Guard soldiers compared to their active duty counterparts. Some studies suggest that Guard soldiers may be at greater risk of deployment stressors and adverse mental health effects of war than active duty soldiers (Smith *et al.*, 2008; Sollinger *et al.*, 2008). For example, Guard soldiers deployed to conflict areas are exposed to the same combat experiences as active duty personnel but face different deployment stressors, including maintaining a civilian job while deployed and deploying with a unit with which they did not train (Hotopf *et al.*, 2006; La Bash *et al.*, 2009; Vogt *et al.*, 2008). Additionally, National Guard veterans face different stressors upon returning home including limited access to healthcare compared to active duty soldiers (Milliken *et al.*, 2007). Milliken et al [2007] screened soldiers 6 months after their return from Iraq and found that, compared with active duty forces, twice as many

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reserve members required referral for mental health problems. As we approach the end of OEF and OIF and given the lack of understanding about how deployment affects reserve forces overtime, there is a need to document mental health over time in this population.

The Ohio Army National Guard Mental Health Initiative (OHARNG MHI) is a longitudinal study that annually monitors the factors associated with and course of mental health within a representative sample of service members from the Ohio Army National Guard (Calabrese *et al.*, 2011; Goldmann *et al.*, 2012). We report here: (a) prevalence of mental health conditions and (b) psychometrics of the structured mental health assessment instruments for the baseline sample.

Methods

Study Population and Sampling
The study population of the OHARNG MHI is the OHARNG soldiers who served in the Guard between June 2008 and February 2009; the final study sample is 2616 randomly selected OHARNG soldiers [men and women, 18 years or older,(with some 17 year old emancipated minors) of any ethnicity and capable of informed consent]. OHARNG soldiers were invited to participate through a process that included, first, a letter alerting soldiers of the study with an option to opt-out and, second, a phone call to obtain each soldier's consent to participate in a telephone interview.

During the first stage of enrollment, all soldiers enlisted in the OHARNG between June 2008 and February 2009 received alert-letters directly from the OHARNG (N=12,225 excludes the 345 without an address). Of all guard soldiers who received the alert-letters, 8% (1013 soldiers) returned opt-out cards to the OHARNG.

During the second stage of enrollment, we contacted possible participants to obtain informed consents for the telephone interviews. If the service member was deployed at the time of contact, information was requested on when the member would return and a

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call was scheduled. If after 10 telephone calls for a 2 week period at different times of the day and contact was unsuccessful, a non-contact letter was sent to the possible participant's address in an attempt to obtain a working telephone number.

The consent procedure and survey were piloted in November 2008 with 15 service members using a computer-assisted telephone interview (CATI). Official enrolment began in December 2008 and continued through the end of November 2009 when the desired sample size was reached. Participants were compensated for their time.

Clinical re-appraisal

We also conducted clinical reappraisals on a sub-sample of the telephone survey participants. At the end of the initial telephone interviews, a random sample of 500 participants participated in the in-depth clinical interview. In person interviews were conducted by clinicians, took place in a setting familiar to the participant, averaged 2 hours, and participants were compensated for their time.

Assessment Instruments

The OHARNG Mental Health Initiative CATI included questions on lifetime experiences, deployment and military experiences, current living situation, and past and present symptoms of psychopathology.

Psychopathologies were assessed using standardized and well-validated scales. The Posttraumatic Stress Disorder (PTSD) Checklist (PCL) (Blanchard *et al.*, 1996) was used to collect PTSD symptoms in relation to participants' self-identified "worst" event experienced both outside and during their most recent deployments (Blake *et al.*, 1995; Hoge *et al.*, 2004; Weathers *et al.*, 1999). Questions were added to assess additional criteria for PTSD diagnosis as listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) ("Diagnostic and Statistical Manual of Mental Health Disorders", 2000). To have had PTSD, a person had to experience criterion A1 and A2 (experience a traumatic event and intense fear, hopelessness or horror due to a trauma); criterion B

where at least 1 symptom of re-experiencing the trauma was reported; criterion C where at least 3 symptoms of avoidance of the trauma were reported; criterion D where at least 2 symptoms of increased arousal were reported; criterion E where symptoms lasted for at least 1 month; and criterion F where the symptoms caused significant impairment ("Diagnostic and Statistical Manual of Mental Health Disorders", 2000; Weathers *et al.*, 1991).

To assess depressive episodes and obtain occurrence of suicidal ideation, we used the Primary Care Evaluation of Mental Health Disorders Patient Health Questionnaire – 9 (PHQ-9) (Kroenke *et al.*, 2001). To have had a major depressive disorder (MDD), the participant had to report $\geq$ 5 of 9 symptoms on the PHQ-9 and symptoms had to occur together within a 2-week period along with either depressed mood or anhedonia. We also examined a more inclusive definition of depression defined by those who, within a 2 week period with either depressed mood or anhedonia, scored $\geq$ 2 out of 9 symptoms on the PHQ-9 (Kroenke *et al.*, 2001). Suicidal ideation was assessed through the PHQ-9 question asking whether participants had thoughts of death or wanting to hurt themselves within the past 30 days (Kroenke *et al.*, 2001).

GAD was assessed with the Generalized Anxiety Disorder – 7 (GAD-7) (Spitzer *et al.*, 2006). A probable case of GAD was classified as a score $\geq$ 10 on the GAD-7, duration of symptoms at least 6 months, reported functional impairment, with symptoms grouped together (Spitzer *et al.*, 2006). As the clinical re-appraisal interview only captured current cases, we only examined current cases of GAD in the past 30 days.

The Mini International Neuropsychiatric Interview (MINI) and DSM-IV criteria were used to assess alcohol dependence and alcohol abuse (Sheehan *et al.*, 1998). Participants with lifetime alcohol abuse ever in lifetime met DSM-IV criterion 1 (at least 1 symptom of maladaptive pattern of substance use leading to clinically significant impairment or distress) and criterion 2 (symptoms never met the criteria for alcohol dependence)

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("Diagnostic and Statistical Manual of Mental Health Disorders", 2000; Sheehan *et al.*, 1998). Those with alcohol dependence ever in lifetime met at least 3 symptoms of maladaptive pattern of alcohol use leading to clinically significant impairment or distress ("Diagnostic and Statistical Manual of Mental Health Disorders", 2000; Sheehan *et al.*, 1998).

Clinical reappraisal instruments

For the clinical reappraisal, the Clinician-Administered PTSD Scale (CAPS) was used to assess PTSD based on the "worst" event outside of their deployments as well as the "worst" event during any deployment; deployment events were not limited to the most recent deployment as with the telephone interview (Blake *et al.*, 1995; Weathers *et al.*, 1999). The diagnosis of PTSD for the clinical reappraisal was based on the scoring rules outlined by Weathers, et al [1999] for the CAPS and followed the DSM-IV algorithm ("Diagnostic and Statistical Manual of Mental Health Disorders", 2000; Blake *et al.*, 1995; Weathers *et al.*, 1999). To have a positive symptom for DSM-IV PTSD criteria B – D, a participant had to have a frequency ≥ 1 per symptom (at least once or twice in their lifetime) as well as a symptom intensity of ≥ 2 (at least moderate -- distress clearly present but still manageable and some disruption of activities). To be diagnosed with PTSD a participant had to have all criteria from the DSM-IV (A-F)

The diagnoses for lifetime occurrence of MDD, alcohol abuse and alcohol dependence, and current occurrence of GAD were based on the Structured Clinical Interview for DSM-IV-TR (SCID) Axis I Disorders (non-patient version) and DSM-IV criteria ("Diagnostic and Statistical Manual of Mental Health Disorders", 2000; First, 2002).

Suicidal ideation was evaluated using MINI Plus (Sheehan *et al.*, 1998). A positive response was a score of at least 'moderately' (9 points or greater) on the question of suicide attempts in the past 6 months.

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Statistical Methods

First, we compared the distribution of demographic characteristics (e.g., age, gender, and education) from those in the baseline sample (telephone survey (N=2616)) and those later selected to participate in the clinical reappraisal (N=500) using chi-square tests.

Second, the lifetime prevalence of each psychopathology – PTSD, MDD, other forms of depression, GAD (past 30 days), alcohol abuse, alcohol dependence, and suicidal ideation (past 30 days)– was described for the entire baseline sample.

Third, we examined the validity and reliability of the telephone assessments compared with the clinical reappraisal. Using the 500 participants who were in both samples, we applied 4 tests of validity and 3 tests of reliability following methods presented by Kessler et al [2005b] in the National Co-morbidity Survey Replication (NCS-R) (Kessler *et al.*, 2005b).

To assess validity and using the clinical reappraisal as the gold standard, we calculated the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for all psychopathologies. Next, using the overall continuous score from each of the psychopathology scales, we examined the area under the curve (AUC) as a measure of overall accuracy based on the continuous score of the telephone assessment and the gold standard of the clinical interview. All standard errors reported were asymptotic.

To assess reliability, we calculated the kappa statistic and the McNemar's statistic between diagnoses according to the telephone interview and clinical reappraisal. The final measure of reliability was Cronbach's alpha applied to the telephone survey questions.

Finally, to test whether disease misclassification between the telephone and the clinical reappraisal depended on participant characteristics, we compared the sensitivity and

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specificity for each psychopathology calculated separately for men and women, participants < 35 and ≥ 35 years of age, and white and non-white categories. Confidence intervals (CI) for these statistics were asymptotic unless the sample size was ≤ 50, in which case exact CIs were reported.

Results

Of the 11,212 soldiers for whom contact information was received from the Guard, 10.1% (1130) were excluded because they did not have a listed telephone number or address and 31.8% (3568) were excluded due to non-functioning or incorrect numbers and not returning a non-contact letter (Figure 1). Of the 6514 possible participants with working numbers (58.1% of the original telephone number list), only 20.9% (1364) declined to participate and 36.0% (2347) were not included because they were not enrolled before the baseline cohort closed in November 2009 (n=2316) or disqualified for other reasons (e.g., did not speak English, hearing problems, or deceased, n=31). 187 were retired and therefore ineligible. Overall, our participation rate was 43.2% calculated as those who completed the telephone survey plus those who would have consented had they not been retired divided by all of the working numbers minus those disqualified for other reasons.

There were no differences between the characteristics of the baseline and clinical reappraisal samples (Table 1). The majority of participants were male (85.2%), white (87.7%), and non-officers, including enlisted soldiers, cadets, or civilian employees (86.9%). The majority had some form of deployment/mobilization experience (35.9% never deployed in the baseline sample); 30.3% of the sample were most recently deployed to a conflict setting.

Table 2 lists the prevalence of each condition in the total baseline sample. The most commonly reported lifetime condition was alcohol abuse (24.0%) followed by alcohol dependence (23.5%). 10.3 % of the sample had MDD at some point in their lives and 21.4% had some form of depression (MDD including other forms of depression).

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Deployment-related PTSD was reported by 7.4% of the telephone sample while 9.6% had PTSD ever in lifetime. GAD (1.7%) and suicide risk (1.9%) were rarely reported

For the validity measures (Table 3), specificity and NPV were higher than sensitivity and PPV for all diagnoses. The telephone diagnosis was most sensitive for alcohol dependence (0.60) and least sensitive for GAD (0.04). The telephone diagnosis was most specific for GAD (0.98) and least specific for alcohol abuse (0.80). The PPV varied but was moderate to low for all conditions, the highest being for MDD (0.64). The NPV was very high for all conditions, the lowest being for alcohol abuse (0.77). Reliability statistical testing results (Table 3) produced relatively moderate kappa values, for example, 0.34 for PTSD ever in lifetime and 0.37 for alcohol dependence. McNemar's test rejected the null hypothesis of no marginal heterogeneity between the telephone sample and clinical interview subsample for PTSD, MDD, GAD, and alcohol dependence. The measure of reliability and internal agreement for the telephone psychopathologies reported by Cronbach's alpha ranged from 0.95 for deployment-related PTSD to 0.57 for alcohol abuse.

The sensitivity and specificity of the telephone diagnoses stratified by gender, age, and race across the psychopathologies showed no misclassification related to these demographic variables (Table 4). There was evidence of misclassification for alcohol abuse by gender; the sensitivity and specificity for alcohol abuse was higher for men than women.

Discussion

In an assessment of a representative sample of Ohio National Guard members, the prevalence of alcohol disorders documented was notably higher than that reported in the general population (Kessler *et al.*, 2005b). We found a 24.0% lifetime prevalence of alcohol abuse and 23.5% for alcohol dependence; these estimates were nearly double

the 13.2% lifetime prevalence of alcohol abuse and 5 times greater than the 5.4% lifetime prevalence for alcohol dependence in the general population (Kessler *et al.*, 2005b). This finding is supported by other studies that have focused on reserve forces (Iversen *et al.*, 2009; Riddle *et al.*, 2007). Second to alcohol disorders was the 10.3% prevalence of MDD at some point in soldiers' lifetimes. This lifetime prevalence is comparable with, if a bit lower than the 16.6% reported in the general population, although this is a substantially younger population (Kessler *et al.*, 2005b). Relative to other psychopathologies, our findings are supported by those reported for a UK reserve sample in which MDD was the second most prevalent condition among the Reserve/Guard (Iversen *et al.*, 2009). In combination with the high prevalence of alcohol disorders, the prevalence of MDD in the Guard population suggests that future work should focus on understanding the burden of substance abuse and mood disorders in this group.

The lifetime prevalence of PTSD was 9.6% and comparable with the range (6.8% - 9.2%) of lifetime PTSD prevalences reported in the general population [Kessler et al, 2005b; Breslau et al, 1998]. In contrast, other military samples have reported a higher prevalence of PTSD than in the general population, perhaps due to inclusion of active duty personnel as well as Guard and reserve forces (Dohrenwend *et al.*, 2006; Kulka, 1990).

Both GAD and suicidal ideation were rarely reported in our study, a finding supported both in the NSC-R and the study of UK reservists (Iversen *et al.*, 2009; Kessler *et al.*, 2005b).

Overall, the validity and reliability statistics for the telephone psychopathology assessment indicated that the methods performed well as instruments for research on PTSD, depression, alcohol abuse, and suicide risk.

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All structured screening instruments had high specificity, a necessary characteristic in order to accurately estimate population prevalences (Terhakopian *et al.*, 2008). The sensitivity and specificity for nearly all of the psychopathology diagnoses in the telephone sample did not differ by demographic group, suggesting there was not differential misclassification. This implies that any misdiagnoses for these conditions are random, rather than based on participant characteristics. There was, however, some suggestion that alcohol abuse may be misclassified by gender; women were less likely to be correctly diagnosed than men.

The telephone assessments had moderate to high levels of reliability across the three measures assessed: kappa, Cronbach's alpha, and McNemar's test. The kappa statistics were fair for suicide risk and all diagnoses with the exception of GAD, suggesting that agreement between the telephone and clinical diagnoses was not due to chance, other than possibly for GAD (Table 3). However, the statistics for GAD showed good internal consistency. Spitzer [2006] reported a Cronbach alpha of 0.92 for his GAD validation study, higher than ours (0.72), but comparable (Spitzer *et al.*, 2006). The other Cronbach alphas in Table 3 also indicate consistency and that the index questions represented the same underlying construct.

Lastly, for McNemar's test of reliability, the finding that psychopathology diagnostic results for several conditions did not reject the null of marginal homogeneity suggested that the telephone assessment and clinical interview were using the same core criteria for diagnoses of alcohol abuse, any depressive disorder, and suicide risk. In comparison, PTSD, MDD, GAD, and alcohol dependence tests rejected the null of marginal homogeneity, suggesting some differences in the core diagnostic criteria between the telephone and the clinical interview subsample. As the MDD diagnosed on the telephone compared to the clinical interview varied, we compared the general depression (including MDD and other forms of depression) prevalence from the telephone sample with MDD in the clinical interview subsample. We found these two

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diagnostic tests were more reliable and appeared to use the same diagnostic criteria. It is of note that in the NCS-R, Kessler, et al [2005b] reported comparable reliability statistics for these psychopathologies. However, Kessler et al found core diagnostic differences by McNemar's test between the World Health Organization Composite International Diagnostic Interview (CIDI) and the SCID for PTSD, MDD, alcohol abuse, and alcohol dependence, whereas we found differences for PTSD, MDD, GAD, and alcohol dependence.

Reliability statistics are population dependent, so it is important to understand that the findings from this military population study may not be generalized to other populations. The current study is also limited by the small percentage of women and other minorities; however, the demographics of our sample very closely mirror the overall demographics of the OHARNG.

Conclusion

The OHARNG Mental Health Initiative will continue to follow the OHARNG members over time. This longitudinal study is expected to advance the knowledge about the trajectories of post-deployment psychopathologies and facilitate enhancements in access to care and treatment of behavioral health issues among National Guard soldiers.

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Table and Figure Legends

Figure 1: 2616 Completed Surveys

Table 1: Participant Characteristics: Telephone Interview Sample Compared with Clinical Interview Subsample

Table 2: Prevalence of Mental Health Conditions for Telephone Interview Sample

Table 3: Reliability and Validity Statistics for the Telephone Assessment Sample by Psychopathology

Table 4: Sensitivity and specificity of psychopathology diagnoses by telephone within specific demographic groups

Table 4 (continued): Sensitivity and specificity of psychopathology diagnoses by telephone within specific demographic groups (continued)

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Table 1: Participant Characteristics: Telephone Interview Sample Compared with Clinical Interview Subsample

Variable[a]	Telephone Interview N = 2616		Clinical Interview N = 500		P-value[b]
	n	%	n	%	
Sex					
Men	2228	85.2	440	88.0	0.10
Women	388	14.8	60	12.0	
Age, yr					
17-24[c]	878	33.6	160	32.0	0.14
25-34	848	32.5	182	36.4	
35-44	634	24.3	103	20.6	
≥45	250	9.6	55	11.0	
Race					
White	2295	87.8	444	88.8	0.73
Black	195	7.5	35	7.0	
Other	123	4.7	20	4.0	
Income					
≤ $60,000	1498	59.1	279	55.8	
> $60,001	1038	40.9	205	38.0	
Education					
High school graduate/GED or less	727	27.8	137	27.4	0.94
Some college or technical training	1234	47.2	240	48.0	
College/Graduate degree	655	25.0	123	24.6	
Marital status					
Married	1227	47.0	238	47.6	0.71
Divorced/Separated/Widowed	252	9.6	53	10.6	
Never married	1134	43.4	209	41.8	
Rank					
Officer	342	13.1	56	11.2	0.25
Enlisted/cadet/civilian employee	2273	86.9	444	88.8	
Most recent deployment location					
Never deployed	939	36.1	173	34.6	0.66
Non-conflict area	872	33.5	178	35.6	
Conflict area	793	30.5	146	29.2	
Number of lifetime deployments					
0-1	1756	67.4	323	64.6	0.49
2-3	682	26.2	143	28.6	
≥ 4	169	6.5	30	6.0	
Total number of traumatic events experienced					
0	141	5.4	23	4.6	0.65
1-5	887	33.9	159	31.8	
6-11	831	31.8	166	33.2	
≥12	757	28.9	152	30.4	

[a] Some percentages do not equal 100% because of missing values.
[b] chi-square tests
[c] Emancipated minors as defined by Ohio state law were eligible.

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Table 2: Prevalence of Mental Health Conditions for Telephone Interview Sample

| | Telephone Interview | |
| | Total (N=2616) | |
Disorder	n	%
Alcohol abuse [a]	628	24.0
Alcohol dependence [b]	615	23.5
Major depressive disorder [c]	270	10.3
Any depressive disorder [d]	560	21.4
Deployment-related PTSD [e,f]	121	9.6
PTSD ever in lifetime [f,g]	249	10.1
Generalized anxiety disorder [h]	45	1.7
Suicide risk[i]	49	1.9

[a] DSM-IV Criterion A (at least 1 symptom of maladaptive pattern of substance use leading to impairment or distress) and Criterion B (does not meet requirements for substance dependence ever in lifetime). Those who reported never having drunk were coded as never having the condition.

[b] DSM-IV Criterion A (at least 3 symptoms of maladaptive pattern of substance use) ever in lifetime and symptoms occurred together; MINI. Those who reported never having drunk were coded as never having the condition.

[c] DSM-IV Criteria; $\geq$ 5 out of 9 on PHQ-9, depressed mood or anhedonia, and symptoms occurred together.

[d] DSM-IV Criteria; $\geq$ 2 out of 9 on PHQ-9, depressed mood or anhedonia, and symptoms occurred together.

[e] Calculated among everyone who have deployment experience (N=1668) minus those who never experienced a deployment related traumatic event (N=374) and those who refused to answer deployment-related PTSD symptoms (N=28). Of the total sample, 9 individuals refused to say if they had ever been deployed and were coded as missing.

[f] DSM-IV Criterion A/A2 and Criteria B - F ever in lifetime.

[g] Calculated among everyone in the sample (N=2616) minus those who never experienced a traumatic event (N=141) and those who refused to answer PTSD symptoms (N=14).

[h] $\geq$ 10 on GAD-7, at least 6 months symptom duration, functional impairment, symptoms occurred together, and presence of symptoms in the past month.

[i] PHQ-9 (thoughts of wanting to hurt themselves in the past 30 days).

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Table 3. Reliability and Validity Statistics for the Telephone Assessment Sample by Psychopathology

Disorder[a]	Sensitivity (SE)[a]	Specificity (SE)[b]	PPV(SE)[d]	NPV(SE)[e]	Kappa (SE)[f]	McNemar's[g]	Cronbach's alpha (standardized)[h]	AUC[i]
Deployment-related PTSD	0.50 (0.13)	0.93 (0.02)	0.35 (0.11)	0.97 (0.01)	0.36 (0.11)	1.8	0.95	0.71
Non-deployment-related PTSD	0.47 (0.13)	0.94 (0.01)	0.23 (0.08)	0.98 (0.01)	0.27 (0.09)	8.0*	0.93	0.74
Any PTSD	0.54 (0.09)	0.92 (0.01)	0.31 (0.01)	0.97 (0.01)	0.34 (0.07)	9.4*	-	-
Major depressive disorder	0.35 (0.05)	0.97 (0.01)	0.64 (0.06)	0.83 (0.02)	0.35 (0.05)	27.4*	0.66	0.77
Any depressive disorder	0.51 (0.05)	0.83 (0.02)	0.46 (0.04)	0.85 (0.02)	0.32 (0.05)	1.4	0.66	0.77
Generalized anxiety disorder	0.04 (0.04)	0.98 (0.1)	0.09 (0.09)	0.95 (0.01)	0.03 (0.05)	5.8*	0.72	0.81
Alcohol abuse	0.40 (0.04)	0.80 (0.02)	0.45 (0.04)	0.77 (0.02)	0.21 (0.04)	1.1	0.57	0.73
Alcohol dependence	0.60 (0.05)	0.81 (0.02)	0.46 (0.04)	0.88 (0.02)	0.37 (0.05)	8.5*	0.76	0.81
Suicide risk	0.32 (0.11)	0.87 (0.01)	0.55 (0.15)	0.97 (0.01)	0.38 (0.11)	3.6	-	-

[a] Criteria for telephone and clinical psychopathology assessments are explained in Table 2 footnotes.

[b] True positive/True positives + False positives with clinical interview as gold standard. SEs are asymptotic.

[c] True negatives/True negatives + False negatives with clinical interview as gold standard. SEs are asymptotic.

[d] True positive/All positives as diagnosed on the telephone. SEs are asymptotic.

[e] True negative/All negatives as diagnosed on the telephone. SEs are asymptotic.

[f] Reliability test of extent to which telephone and clinical diagnoses agree on participant classification. SE are asymptotic.

[g] Reliability test of marginal heterogeneity to see if the telephone and clinical diagnoses used different core criteria. *$P > 0.05$ suggesting differences between clinical interview as gold standard and telephone screening tool.

[h] Reliability test of internal consistency of the measurement items that make up the diagnosis

[i] Measure of overall accuracy based on the continuous score of a diagnostic test. It is the area under the ROC curve,

AUC, area under the curve; NPV, negative predictive value; PPV, positive predictive value; PTSD, post traumatic stress disorder, ROC, receiver operating characteristic; SE, standard error.

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Table 4. Sensitivity and specificity of psychopathology diagnoses by telephone within specific demographic groups

Characteristics	PTSD Ever in Lifetime		Major Depressive Disorder Ever in Lifetime		Generalized Anxiety Disorder	
	Sensitivity (95% CI)[a]	Specificity (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)
Sex						
Male	0.48 (0.28-0.67)	0.93 (0.91-0.96)	0.34 (0.24-0.43)	0.95 (0.92-0.97)	0.06 (0.0-0.29)	0.97 (0.96-0.99)
Female[a]	1 (0.29-1.00)	0.83 (0.70-0.92)	0.41 (0.18-0.67)	0.91 (0.78-0.97)	—[b]	0.98 (0.90-1.0)
Age						
17-34	0.52 (0.30-0.74)	0.93 (0.90-0.96)	0.30 (0.19-0.41)	0.95 (0.92-0.98)	—[b]	0.98 (0.96-1.0)
≥ 35	0.57 (0.18-0.90)	0.91 (0.86-0.96)	0.42 (0.28-0.58)[a]	0.92 (0.88-0.98)	0.13 (0.0-0.53)	0.97 (0.94-1.0)
Race						
White	0.55 (0.32-0.76)	0.93 (0.90-0.95)	0.34 (0.25-0.44)	0.94 (0.92-0.97)	0.05 (0.0-0.25)	0.98 (0.96-0.99)
Non-white[a]	0.50 (0.12-0.88)	0.91 (0.78-0.97)	0.38 (0.14-0.68)	0.98 (0.87-1.00)	—[b]	0.98 (0.89-1.00)

[a] Exact standard errors used to calculate 95% CI due to small sample size (< 50); otherwise asymptotic standard error used based on the fact that the outcome was rare ($P < 0.05$).

[b] n = 0 for either the telephone sample or clinical interview subsample for the specific diagnosis.

CI, confidence interval; PTSD, posttraumatic stress disorder.

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Table 4 (cont). Sensitivity and specificity of psychopathology diagnoses by telephone within specific demographic groups (continued)

	Alcohol Abuse		Alcohol Dependence		Suicide	
Characteristics	Sensitivity (95% CI)	Sensitivity (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)
Sex						
Male	0.37 (0.28 - 0.45)	0.79 (0.74 - 0.83)	0.46 (0.37 - 0.55)	0.88 (0.85 - 0.92)	0.36 (0.13 - 0.65)	0.99 (0.98 - 1.00)
Female	0.67 (0.41 - 0.87)	0.93 (0.81 - 0.99)	0.43 (0.10 - 0.82)	0.92 (0.85 - 1.00)	0.20 (0.01 - 0.72)	0.98 (0.95 - 1.0)
Age						
17-34	0.45 (0.34 - 0.56)	0.78 (0.75 - 0.84)	0.60 (0.49 - 0.72)	0.81 (0.77 - 0.86)	0.20 (0.04 - 0.48)	0.98 (0.96 - 1.0)
≥ 35	0.40 (0.27 - 0.54)	0.75 (0.66 - 0.83)	0.59 (0.39 - 0.76)	0.83 (0.76 - 0.89)	0.75 (0.19 - 0.99)	—[a]
Race						
White	0.40 (0.31 - 0.47)	0.79 (0.75 - 0.84)	0.60 (0.49 - 0.70)	0.81 (0.77 - 0.85)	0.36 (0.13 - 0.65)	0.99 (0.98 - 1.0)
Non-white	0.50 (0.21 - 0.79)	0.86 (0.72 - 0.95)	0.60 (0.15 - 0.95)	0.90 (0.82 - 0.98)	0.20 (0.01 - 0.72)	0.96 (0.86 - 1.0)

[a] n = 0 for either the telephone sample or in-person clinical interview subsample for the specific diagnosis.

CI, confidence interval.

Running title: Prevalence of psychopathology and validation of lay-administered mental health assessments in a large National Guard cohort

Wordcount:1,744

Tables: 2

Cigarette smoking and subsequent risk of suicidal ideation among National Guard Soldiers

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ABSTRACT

BACKGROUND: Suicide rates are alarmingly high among military personnel, and particularly Army National Guard soldiers.Smoking is also disproportionately common in the military. Previous studies havesuggested that smoking is associated with an increased risk of suicide behavior in the general population. No previous study has assessed whether smoking may be related to increased risk of suicide-related outcomes in the National Guard.

OBJECTIVE: To investigate the relationship between cigarette smoking and suicidal ideation among a representative sample of national guardsoldiers.

METHOD: A representative sample of Ohio Army National Guard soldiers were followed prospectively and information was gathered on smoking, suicidal ideation and depression at baseline and one year later.

RESULTS: Smoking at baseline was associated with significantly increased likelihood of suicidal ideation at follow-up (OR=2.0 (1.3, 3.2)). This association persisted after adjusting for demographics and history of depression at baseline, but was no longer statistically significant after adjusting for depression at follow-up.

CONCLUSIONS:Army National Guard soldiers who smoke have a greater risk of subsequent suicidal ideation. Depression concurrent with suicidal ideation appears toexplain this relationship. If these results are replicated, screening of soldiers who smoke may be recommended as a proactive step towards mitigating the high risk of suicide in military personnel.

Military populations are at high risk for suicidal behavior and suicide rates in the military continue to rise [1]. Suicide rates in the US military have increased in recent years, and the most dramatic increase has been among Army National Guard members (22288872). Suicide rates in the Army National Guard are now higher than rates among active duty army personnel(US Army, Office of the Chief of Public Affairs, 2010).

Smoking is also disproportionately prevalent among soldiers (19608945). Cigarettes were included as part of meal rations during World War I and II and the Vietnam War[19743733]. It was not until the early 1970s that the United States (US) Department of Defense issued policies aimed at preventing and treating substance abuse; by 1975 cigarettes were no longer rationed to soldiers [16435763].Trend data show that over the past 28 years cigarette smoking in the US military has decreased; however, the prevalence of cigarette smoking has remainedhigher among military personnel compared to the general population: approximately32% of active duty military personnel are smokers compared to 21% of US adults (17567397).

Results from numerous epidemiologic studies have consistently documented a strong association between cigarette smoking and suicide-related outcomesamong adults in the community[4-6;21443823]. Only one study has examined this relationship among military personnel. Miller and colleagues (2000) found that smoking was associated with completed suicide among active

duty male army soldiers. The study did not consider key potentially mediating factors, such as depression.

Since that study, several things have changed. Active military conflicts over the past decade have led to increased military personnel; each year the US military brings in 300,000 new recruits. Since the start of Operation Iraqi Freedom and Operation Enduring Freedom, National Guard members have been called upon increasingly to serve in combat situations. As of January 2010, there were over 1.1 million active duty personnel serving in the four branches of the US military and 131,066 personnel serving in the National Guard. National Guard members are a distinct and sizable subset of the military, increasingly relied upon for active duty deployments. However, compared with active/full-time military, relatively little is known about mental health risks in this group. In addition, National Guard members are outside the support structures provided to regular military personnel and are, therefore, exposed to an especially heavy burden of chronic civilian stressors post-deployment (e.g., family conflict, job loss) without the benefit of adequate resources to cope with such stressors. Finally, as noted above, the rate of suicide among National Guard members has increased substantially in the past few years (22288872).

To our knowledge, no previous study has examined the potential impact of smoking on subsequent suicide-related outcomes in a reservist population. The current study examined the relationship between smoking and subsequent risk of

suicidal ideation in 2010 in a representative sample of Army National Guard soldiers.

Methods

Study population and survey

Data were drawn from the Ohio Army National Guard Mental Health Initiative (OHARNG MHI). The OHARNG MHI is a longitudinal cohort of Ohio Army National Guard Soldiers who are interviewed annually to assess mental health, substance use and life experiences. All soldiers were asked to participate in the study with the option to opt out. Between June 2008 and February 2009, 11,212 soldiers did not opt out of the study, and accurate contact information was available for 58.1% of participants (n=6,514). This group was further reduced to a final baseline sample of 2,616 after eligibility, language proficiency, and desire to participate were taken into account; survey response rate was 43.2%. Participants were contacted for follow-up interviews in November of 2009, within 12 months of their original interview, and given 12 months to respond. 67.7% of the original 2,616 soldiers responded to follow-up surveys (n=1,770). This study included the 1,770 soldiers who participated in both baseline and follow-up surveys. After giving writteninformed consent, soldiers participated in computer-assisted telephone interviews that obtained information on mental health, substance use, military experiences, and life events history.

Our main dependent variable of interest was whether or not an individual reported having suicidal thoughts, or thoughts of being better off dead or wanting to hurt themselves, at some point between the baseline survey and the follow-up survey. Suicidal ideation was assessed via the question from the Patient Health Questionnaire-9 (PHQ-9) which asked if individuals ever thought of harming themselves or that they would be better off dead[7].

Our main independent variable of interest was whether or not individuals reported that they smoked within 30 days of the baseline survey. Smoking status was also recorded at follow-up assessing if participants reported smoking at any point between their baseline and follow-up survey.

Other covariates included presence of suicidal behavior at baseline and depression at baseline, smoking status at follow-up and depression at follow-up, and age and gender. Depression was assessed using the Patient Health Questionnaire-9 [9]. To have had a history of depression at baseline, individuals had to have at least 2 co-occurring symptoms at some point in the past [9]. To have depression at follow-up, the individual had to have had the same number of symptoms but they must have occurred between the baseline survey and follow-up survey. A concurrent clinical reappraisal conducted with the OHARNG MHI found the PHQ to be highly specific, when compared to clinician- administered interviews [10]. The presence of the conditions (Yes vs No), gender (female vs.

male) and age were included as indicator variables (18-24 (reference), 25-34, 35-44, 45+).

Statistical analysis

First, for everyone who completed a baseline and follow-up survey (N=1770), we compared the distribution of suicidal ideation at follow-up according to baseline and follow-up characteristicsusing bivariable logistic regression. Second, we used multivariable logistic regression to estimate the relation between smoking status at baseline, andsuicidal ideation at follow-up. We ran three multivariable models: (a) we adjusted for potential confounders including age and gender, (b) we adjusted for possible confounders of the effect of baseline smoking on subsequent suicidal ideationincluding age, gender, depression at baseline and suicidal thoughts at baseline,and (c) to isolate the effect of smoking on subsequent suicidal ideation, we used logistic regression adjusting for age, gender, suicidal ideation at baseline, depression at baseline, smoking status as follow-up and depression at follow-up. We also performed a mediation analyses with the third model (c) examining the mediation effects of smoking and depression during follow-up.Finally, we performed sensitivity analysis using the PHQ-8, omitting the suicidal ideation question from the PHQ-9. All analyses were carried out using SAS 9.2.

Results

The distribution (number (%)) and the association (crude odds ratio, 95% CI) of suicidal ideation at follow-up by baseline and follow-up characteristics is shown in Table 1. 30.5% of the sample reported smoking at baseline, themajority of the sample was male (86.1%) and below the age of 35 (64.3%). At baseline, 21.2% of soldiers had a lifetime history of depression and 10.2% had a history of suicidal ideation. At follow-up, 29.6% of soldiers smoked, 12.3% had depression in the past year, and 4.2% reported suicidal ideation in the past year. In bivariable associations, smoking status at baseline was associated with suicidal ideation at follow-up (crude odds ration COR=2.01, 95% confidence interval CI: 1.3-3.2). In addition, history of depression at baseline (COR=5.1, 95% CI: 3.2-8.2), suicidal ideation at baseline (COR=8.0, 95% CI: 4.9-13.0), smoking status at follow-up (COR=2.2, 95% CI 1.4-3.6), and depression at follow-up (COR=19.2, 95% CI: 11.5-32.1) were all associated with suicidal ideation at follow-up.

The adjusted associations (adjusted odds ratio AOR, 95% CI) for the effect of smoking status at baseline and subsequent suicidal ideation are presented in Table 2. Adjusting for age and gender, those who smoked at baseline were more likely to have suicidal thoughts at follow-up (AOR=2.0, 95% CI: 1.3-3.2). However, this effect was not robust and was minimal once we controlled for depression (AOR=1.1, 95% CI: 0.5-2.7) and smoking at follow-up.Sensitivity analysis excluding suicidal ideation as a symptom of depression did not show any differences from these findings (data not shown).

DISCUSSION

Theprevalence of suicide in Army National Guardmembers has been increasing since 2006 and in 2010exceeded the rate among active duty army personnel (22288872).Suicidal ideation is a significant predictor of future suicide behavior, but is also associated with substantial impairment and distress even when it does not lead to suicide behavior[10]. To our knowledge, this is the first study to examine the relationship between smoking and subsequent suicidal ideation in a National Guard population. Our results suggest that active smoking is associated with increased suicidal ideation at follow-up among National Guard soldiers.

There are a number of plausible explanations for this association. One possibility is that smoking leads to increased depression that then increases the risk of suicidal ideation. There is a well-documented relationship between cigarette smoking and increased levels of inflammation [11]. A relationship between major depression and inflammation is also well-documented [12-17]. It is thought that the release of specific inflammatory markers and activation of the immune system may be related to the pathophysiology of depression potentially via the effects of cytokines on specific regions of the brain [12]. Major depression is the strongest known risk factor for suicide behavior [18], and suicide ideation is so entwined with depression that it is part of the diagnostic criteria for major depression [19]. As such, it is reasonable to postulate that inflammation may be related to suicide behavior through similar pathways. Our data support this

pathway (i.e., that depression is a mediator of the relationship). It is also conceivable that the relationship is due to other common causes that we could not evaluate in this study. While it is not possible to definitively identify the mechanism in this study and some studies have suggested that the association between smoking and suicide-related outcomes may be due to confounding[20, 21], the potential importance of smoking as a screen in evaluating suicide risk in this high risk group is clearly supported by our findings.

This study has several limitations that should be considered when interpreting our results. First, we did not have measures of suicide attempt or completion. Suicidal ideation is highly correlated with these behaviors [4, 22-24], and one study of male active-duty army soldiers found a link between smoking and suicide though this study did not adjust for depression[25]. Future studies that can take depression and other mental disorders into account while examining the relationship between smoking and other suicide-related outcomes over time in various military populations are needed. Second, although there is no reason to believe that Ohio Army National Guard members are systematically different from other reservists nationwide, it is possible that our findings may not be generalizable to other National Guard and/or active military personnel. Therefore, additional studies in these vulnerable populations should be carried outtoward replicating these results. Third, our ability to test potential mechanisms of the relationship between smoking and suicidal ideation was limited. Future studies in

military samples will be needed to examine potential mechanisms of these relationships.

If these findings are replicated, future screening efforts that include an assessment of active smoking behavior may suggest National Guard members at greater risk of suicidal ideation, and potential suicidality.

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Table 1. The distribution (number (%)) of selected characteristics in the total sample and the distribution (number (%)) and association (crude odds ratio, 95% CI) of suicidal thoughts in the follow-up survey and selected characteristics.

Characteristics	Total sample (number (%))	Those with suicidal ideation at follow-up (number (%))	COR (95% CI)
Smoked at baseline			
No	1228 (69.5)	40 (3.3)	1
Yes	538 (30.5)	34 (6.32)	2.01 (1.26-3.21)
Gender			
Male	1520 (86.1)	59 (3.9)	1
Female	246 (13.9)	15 (6.1)	1.6 (0.90-2.88)
Age			
18-24	552 (31.3)	26 (4.7)	1
25-34	582 (33.0)	22 (3.8)	0.80 (0.45-1.43)
35-44	438 (24.8)	17 (3.8)	0.82 (0.44-2.53)
45+	193 (10.9)	9 (4.7)	0.99 (0.46-2.15)
History of depression at baseline			
No	1391 (78.8)	33 (2.4)	1
Yes	375 (21.2)	41 (10.9)	5.1 (3.2-8.2)
History of suicidal thoughts at			

baseline

No	1583 (89.6)	42 (2.7)	1
Yes	180 (10.2)	32 (17.8)	8.0 (4.9-13.0)

Smoked at follow-up

No	1244 (70.4)	39 (3.1)	1
Yes	522 (29.6)	35 (6.7)	2.2 (1.4-3.6)

Depression at follow-up

No	1549 (87.7)	24 (1.6)	1
Yes	217 (12.3)	50 (23.0)	19.2 (11.5-32.1)
Total	**1766**	**74 (4.2)**	

Table 2. The adjusted association (AOR, 95% CI) between the covariates of interest and suicidal ideation after one year of follow-up.

	AOR (95% CI)	Total Effect AOR (95% CI)	Direct Effect AOR (95% CI)
Smoked at baseline			
No	1	1 1	
Yes	2.01 (1.25-3.22)	1.69 (1.03-2.77)	1.11 (0.46-2.70)
Gender			
Male	1	1 1	
Female	1.58 (0.88-2.87)	1.32 (0.71-2.45)	1.17 (0.60-2.29)
Age			
18-24	1	1 1	
25-34	0.84 (0.47-1.51)	0.80 (0.43-1.46)	0.67 (0.34-1.30)
35-44	0.95 (0.50-1.79)	0.95 (0.49-1.85)	0.89 (0.44-1.81)
45+	1.16 (0.53-2.54)	1.04 (0.46-2.36)	1.07 (0.45-2.53)
History of depression			
No		1	1
Yes		2.74 (1.58-4.73)	1.37 (0.77-2.45)
History of suicidal thoughts			
No		1	1
Yes		4.64 (2.65-8.12)	4.17 (2.32-7.50)

Smoked at follow-up		
No	1	
Yes	1.57	(0.65-3.79)

Depression at follow-up		
No	1	
Yes	13.2	(7.56-23.0)

-2 Log likelihood	**603.0**	**535.5**	**445.2**

Wordcount: 1,484

Tables: 1

Does smokingpredict depressiononset among military personnel?

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BACKGROUND: Recent studies suggest a disproportionately high level of depression in military populations. The reason for this is not known. Smoking is also exceedingly common among soldiers. Several studies have documented a relationship between smoking and increased depression among general population samples. The potential impact of smoking on depression in the military has not been examined.

OBJECTIVES: To investigate the relationship between smoking and depression in a representative sample of Ohio Army National Guard soldiers.

METHOD: A representative sample of Ohio Army National Guard participants were followed prospectively and information was gathered on smoking and depression at baseline and follow-up one year later.

RESULTS: Persistent, active smoking is associated with increased risk of incident depression at follow up.History of smoking in the absence of current smoking at baseline was not associated with depression at follow-up.

CONCLUSIONS: Our results suggest smoking may increase vulnerability to depression onset among military personnel. If replicated, these findings suggest that another benefit to smoking cessation may be decreasing an individual's vulnerability to depression.

Major depression is increasingly recognized as a serious heal th problem among military personnel in the US(1). The National Guard i s a s ubgroup of the US military among whom rates of depression are even higher than among active military personnel(2). Smoking is also disproportionately common among military service personnel(3). C igarette smoking has a l ong history of being to lerated and even encouraged in American military culture(4, 5). Trend data show that over the past 28 year s cigarette smoking in the U S military has decreased.However, the prevalence of cigarette smoking remains higher among military personnel compared to the general populati on; 31% of active duty military personnel compared to 21% of US adults are current smokers(6).

Recently several general population studies have documented a link between smoking and increased risk of depression(7-11). Previous studies have not examined this relationship in a military population. Against this background, this study assessed the relationship between depression and smoking in a representative sample of national guard members.

METHOD

Study population and survey

Data were drawn from the Ohio Army National Guard Health Initiative (OHARNG MHI). The OHARNG MHI is a longitudinal cohort of Ohio Army National Guard Soldiers who are interviewed annually to assess mental health, substance use

and life experiences. All soldiers were asked to participate in the study with the option to opt out. Between June 2008 and February 2009, 11,212 soldiers did not opt out of the study, and accurate contact information was available for 58.1% of participants (n=6,514). This group was further reduced to a final baseline sample of 2,616 after eligibility, language proficiency, and desire to participate were taken into account; the overall survey response rate was43.2%. Participants were contacted for follow-up interviews in November of 2009, within 12 months of their original interview, and given 12 months to respond. 67.7% of the original 2,616 soldiers responded to follow-up surveys (n=1,770). This study included the 1,770 soldiers who participated in both baseline and follow-up surveys. After giving written, informed consent, soldiers participated in computer -assisted telephone interviews that obtained information on mental health, substance use, military experiences, and life events history.

Measures

Our main independent variable of interest was whether or not an individual reported smoking at baseline. Our main dependent variable of interest was depression status at time 2. The Patient Health Questionnaire-9 was used to evaluate depression(12). Incident depression at time 2 was defined as having two symptoms at follow-up and they must have occurred between the baseline survey and follow-up survey among participants with no history of depression at baseline (individuals had to have had at least 2 co-occurring symptoms at some point in the past to be considered to have a history of depression at baseline

(12)). A concurrent clinical reappraisal was conducted with the OHARNG MHI and found the PHQ to be highly specific, compared to clinician- administered interviews (13).

Other covariates included smoking status at follow-up, age and gender. Age was included as an indicator variable (18-24 (reference), 25-34, 35-44, 45+).

Statistical analysis

For the study sample, we eliminated those who did not answer the smoking series of questions (N=4) and included only those who were at risk for incident depression at follow-up (N=1391). To be considered at risk, we excluded those who ever had a history of depression as reported in the baseline survey (375). Within this sample, we first examined the distribution of incident depression among those who were and were not smoking. We also examined the distribution of incident depression among the multiple categories of smoking (never, history but not currently, on and off again, incident smoker, chronic smoker). We used unadjusted logistic regression to estimate the crude association between smoking status and incident depression. We then used adjusted logistic regression to estimate the crude association between smoking status and incident depression adjusting for age and gender.

RESULTS

The distribution (number (%)) and the association (crude odds ratio, 95% CI) of depression at follow-up according to the baseline and follow-up characteristics is listed in Table 1. 28.5% of the sample reported smoking at baseline; the majority of the sample was male (86.1%) and below the age of 35 (64.3%). In bivariablecross-sectional associations, smoking status at baseline was associated with depression atbaseline (crude odds ration COR=1.6, 95% confidence interval CI: 1.0-2.4). History of smoking (but not current), sporadic/inconsistent smoking and incident smoking at baseline were not associated with increased risk of depression at follow-up, but chronic smoking was associated with significantly increased risk of incident depression at follow-up (COR=1.9, 95% CI: 1.2-3.2). This association remained statistically significant after adjusting for demographic differences.

DISCUSSION

In the first study of the relationship between smoking and depression over time among military personnel, we found that persistent smoking is associated with incident depression among National Guard soldiers. This finding is consistent with results from several longitudinal studies showing that smoking is associated with increased risk of depression (7-9, 14) in general population samples.

There are four main explanations for the observations noted here. First, while the military has traditionally experienced higher rates of smoking than the general population, recently there have been targeted efforts to improve smoking

cessation in the military (15). Therefore, it is conceivable that depression could result from increased exposure to stigma among remaining smokers though this seems less likely in the military than among some other population subgroups. Second, there is a near-perpetual state of withdrawal among chronic smokers, beginning after the effects of the last cigarette wear off. Since soldiers are frequently unable to smoke at will while fulfilling their duties, it is possible that they are more vulnerable to depression via increased exposure to withdrawal symptoms than the civilian population. Third, it is possible that smoking influences the brain through depletion of serotonin due to frequent nicotine use, leading to increased vulnerability to depression via neurobiological pathways(16). Fourth, the relationship between smoking and depression among National Guard members could result from uncontrolled confounding. For example, anxiety disorders, substance use disorders (i.e. alcohol and illicit substances) and exposure to traumatic events are all associated with increased smoking and depression(17-19). It is possible that exposure to one of these factors results in the observed association.

Limitations of this study should be considered. First, while we were able to examine levels of smoking at two time points, we did not have any measure of nicotine dependence. Future studies that can differentiate between dependent and non-dependent smoking, including an examination of withdrawal symptoms in the relationship between smoking and depression will lead to a better understanding of the relationship between smoking and depression in the

military. Second, due to fairly small cell sizes we were not able to adjust for a number of potential confounders (e.g., exposure to traumatic experiences, substance use disorders, other mental disorders). Yet, numerous previous studies have examined potential confounders and the relationship has remained significant.

The current study provides evidence that smoking is associated with incident depression, and provides the first evidence of a relationship between smoking and depression among National Guard members. As smoking continues to be highly prevalent among military personnel, these data suggest the burden of mental health – as well as physical health – consequences of smoking.   As such, the importance of making smoking cessation programs available to soldiers cannot be overestimated.

Table 1. Distribution (N(%)) of smoking characteristics among those at risk for incident depression (never had depression at baseline) and the distribution (N(%)) of incidence of depression at follow-up; and the estimated association (crude odds ratio (COR), 95% CI) and adjusted association (AOR), 95% CI) between smoking status and incident depression.

Smoking status	Total	Incident occurrence of depression	Crude Odds Ratio (95% CI)	Adjusted* Odds Ratio (95% CI)
Smoked at baseline				
No	995 (71.5)		1	1
Yes	396 (28.5)	37 (9.3)	1.6 (1.0, 2.4)	1.7 (1.1, 2.5)
Categories of smoking				
Never smoked	586 (42.2)	31 (5.3)	1	1
History of smoking but not currently	366 (26.3)	24 (6.6)	1.3 (0.7, 2.2)	1.2 (0.7, 2.1)
On and off smoker	71 (5.1)	7 (9.9)	2.0 (0.8, 4.6)	2.2 (0.9, 5.2)
Incident smoker	19 (1.4)	2 (10.5)	2.1 (0.5, 9.5)	2.7 (0.6, 12.4)
Chronic smoker	349 (25.1)	34 (9.7)	1.9 (1.2, 3.2)	2.0 (1.2, 3.4)
Total				

*Models were adjusted for age and gender

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Ohio Army National Guard
Mental Health Initiative

OHIO NATIONAL GUARD STUDY

Outline

- ONG sample after 3 waves

  - attrition

  - prevalence and incidence of psychiatric disorder

  - trajectories of PTSD

- Analyses

  1. mental health service utilization

  2. deployment and risky driving behavior

  3. PTSD and HIV risk behavior

  4. sexual trauma and psychiatric comorbidity

  5. differences between war and civilian-related PTSD

  6. alcohol dependence and incident suicidal ideation

  7. tobacco use and risk of depression and suicidal ideation

The ONG sample after 3 waves

Participation flow chart

Wave 1(completed)

10,778 OHANG soldiers in the guard

6501 selected to participate

1043 randomly selected for clinical interview

2616 soldiers participate in telephone interview

500 participate in clinical interview

Replenishment sample (ongoing)

671 new OHARNG soldiers participate in telephone interview (62% cooperation)

114 new participants in clinical interview

Wave 2 (completed)

1770 OHARNG soldiers completed second telephone interview to date (93.4% cooperation)

418 participated in second clinical interview

Wave 3 (ongoing)

1341 OHARNG soldiers completed third telephone interview to date (88.6% cooperation)

354 participated in third clinical interview to date

Wave 4 (ongoing)

632 OHARNG soldiers completed fourth telephone interview to date (88.4% cooperation)

176 participated in fourth clinical interview to date

Wave 1 (current and lifetime questions)

10,778 Men and Women in the Ohio Army National Guard (OHARNG)

→ **345 (2.7%) No Current Address**
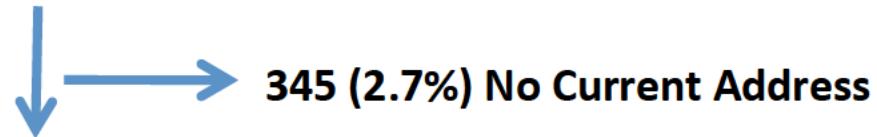
6,700 randomly sampled OHARNG personnel received alert letter

→ 610 (9.0%) Opted Out
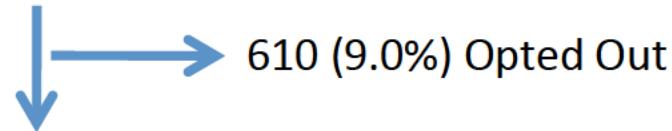
2,616 OHARNG participate in telephone interview
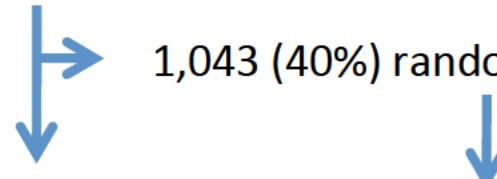
→ 1,043 (40%) randomly selected for in-person

2,616 OHARNG participants followed annually with telephone interviews

500 in-person interviews sub-sample followed annually

Initial opt-out rate <10%, telephone cooperation rates 68%, and in-person cooperation rates 98%

•5

Wave 2: W1 questions
plus hypomania, suicide, and drug use

Telephone Interviews

In-Person Interviews

2,616 OHARNG Baseline
Telephone Interviews

500 OHARNG
Baseline In-Person Interviews

Genetics Repository
begins 5/3/2010

1,770 (67.6%) OHARNG Wave 2
Telephone Interviews

276 participants return
saliva sample

418 (83.6%) OHARNG Wave 2
In-Person Interviews
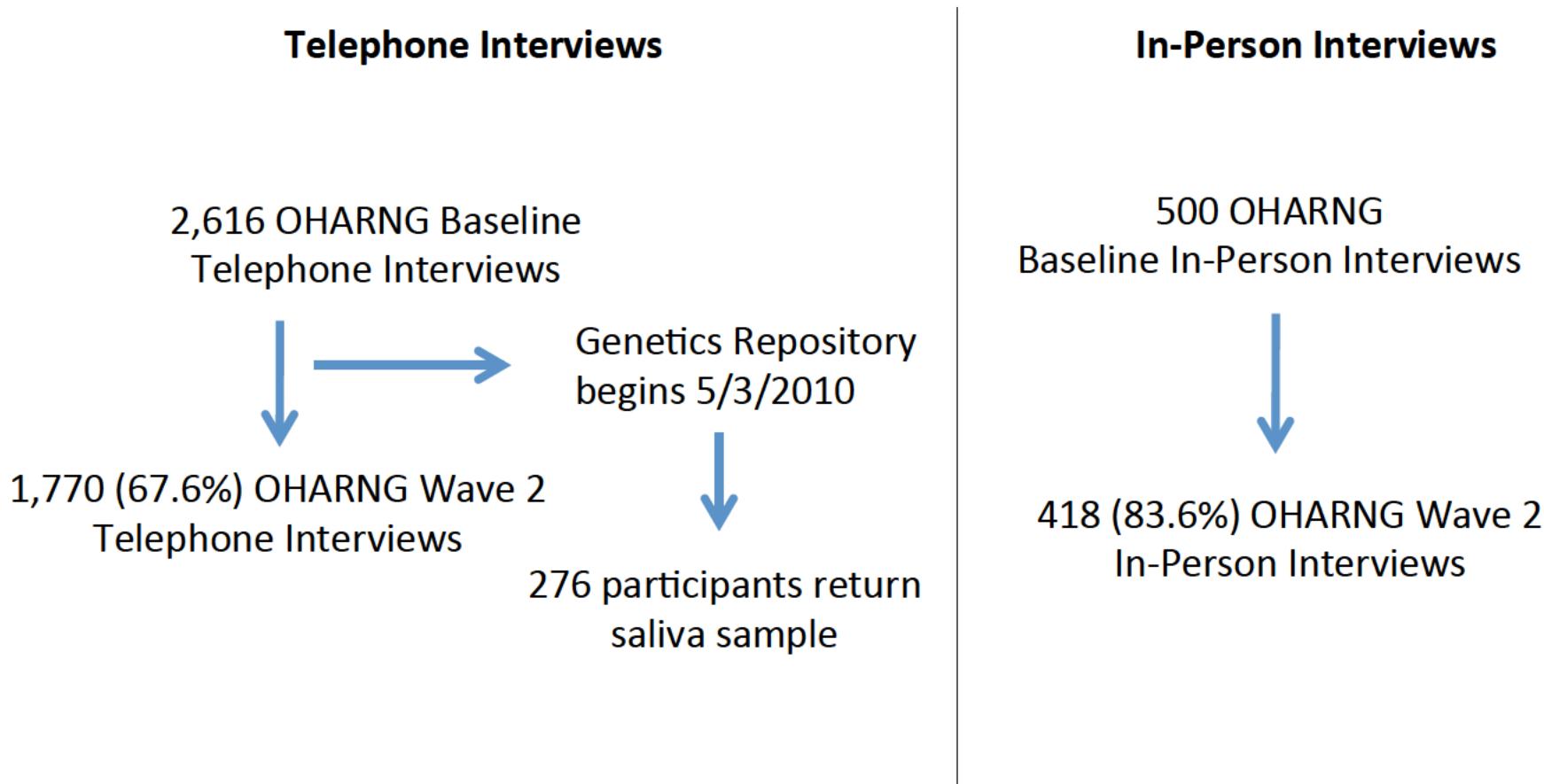
Wave 3: New questions -
drug dependence, legal problems, & self-medication

Telephone Interviews

2,598 approached for W3
Telephone Interviews

↓

1,344 (88.6%)
OHARNG Wave 3
Telephone Interviews
*W3 closes 7/31/2012

Dynamic Cohort began
11/17/2010

↓

578 (65.8%)
DC-B Telephone
Interviews

695 (57%) returned
Genetics Kit

In-Person Interviews

494 approached for W3
In-Person Interview

↓

354 (72%) W3
In-Person Interviews

Dynamic Cohort
began 1/5/2011

↓

104 Dynamic Cohort
Interviews

Wave 4: Translational Focus
- military alcohol use, ONG Battle Buddy program, stigma and healthcare utilization

Telephone Interviews

In-Person Interviews

2,598 being approached for W4 Telephone Interviews

Dynamic Cohort began 2/09/2012

458 approached for W3 In-Person Interview

Dynamic Cohort began 2/2/2012

632 (88.9%) W4
*W4 closes 7/31/2013

106 (59.9.8%) DC-B Telephone Interviews

119 W4 In-Person Interviews

11 Dynamic Cohort Interviews

32 returned Genetics Kit thus far

•8
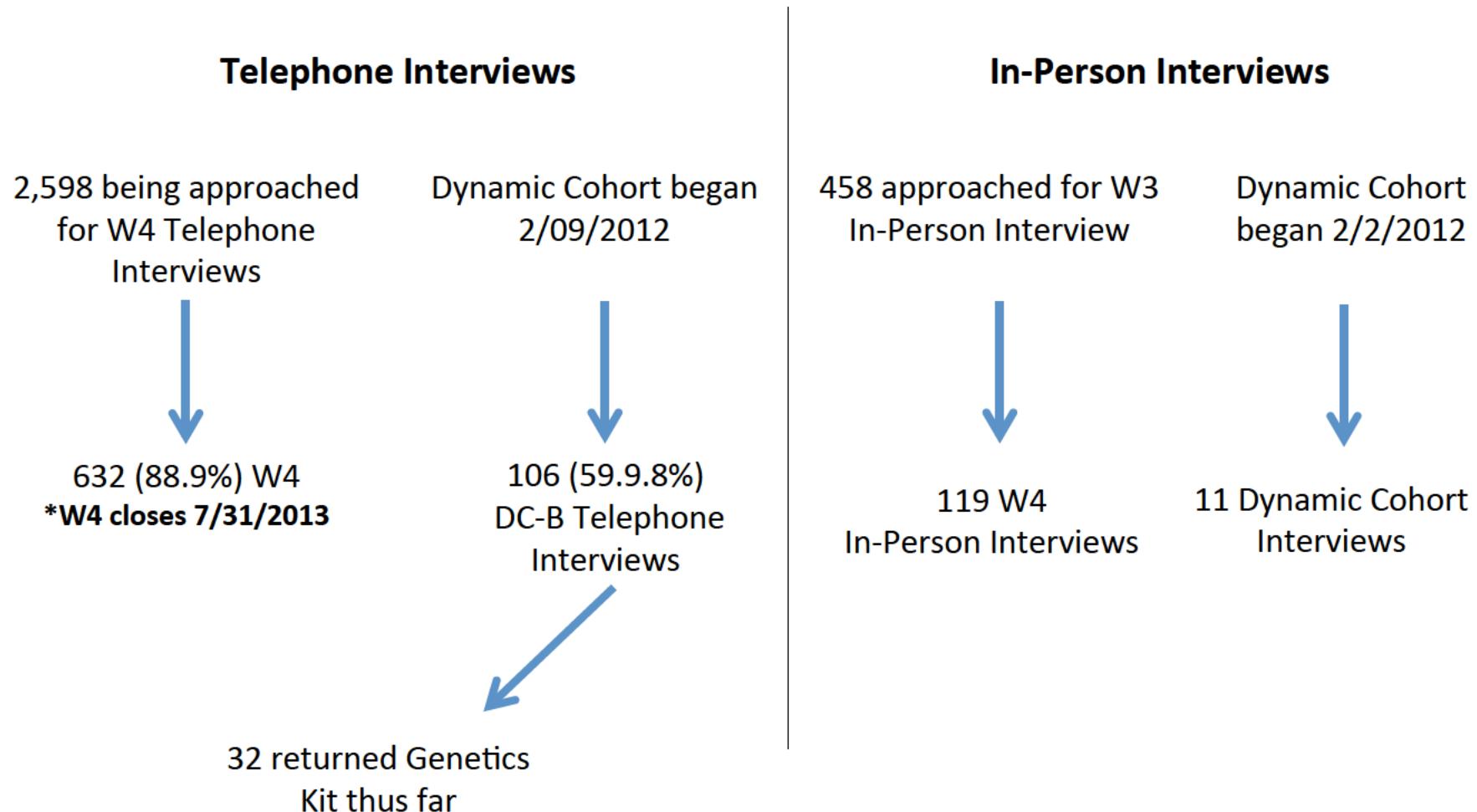
Telephone sample demographics (1)
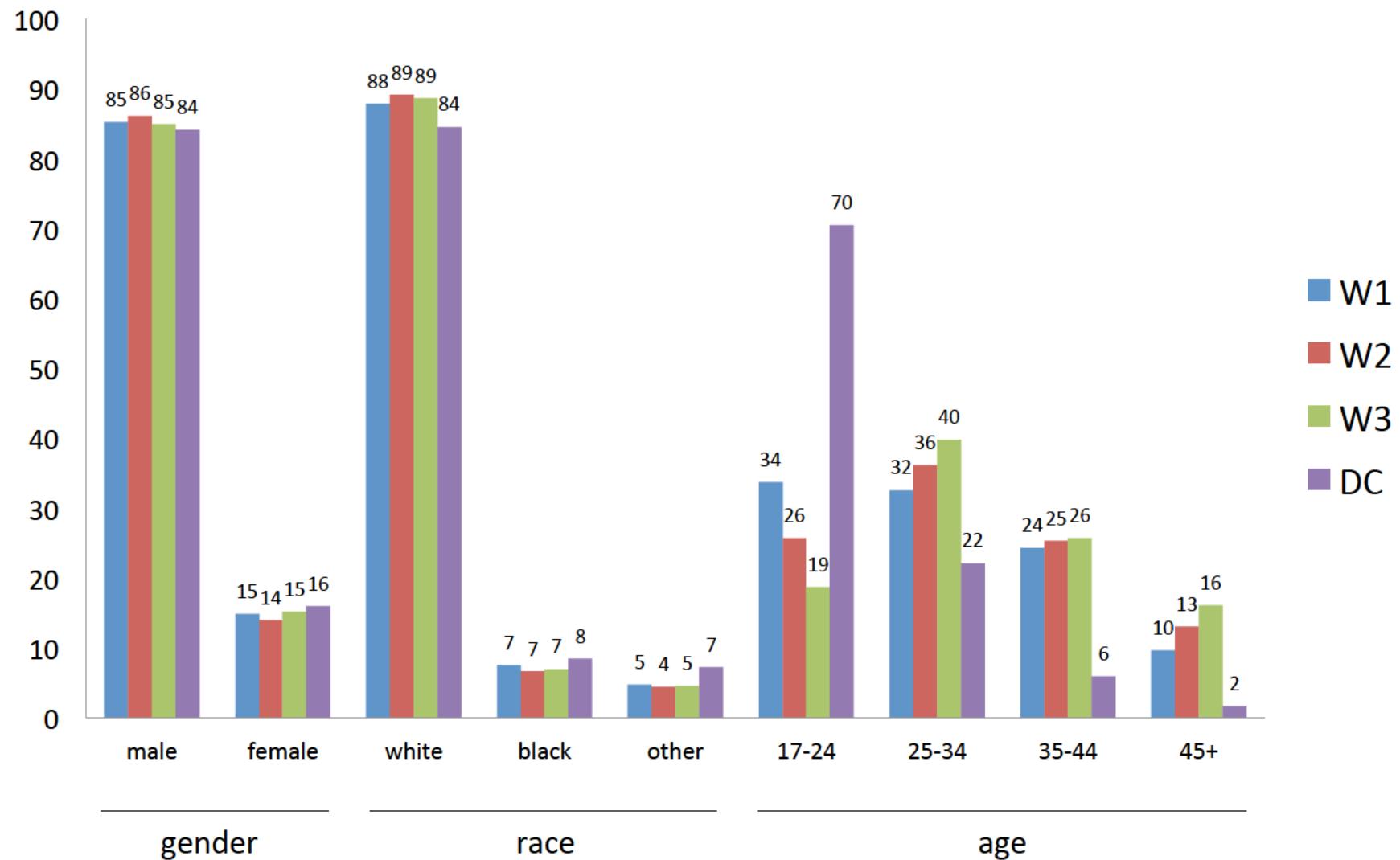
Telephone sample demographics (2)
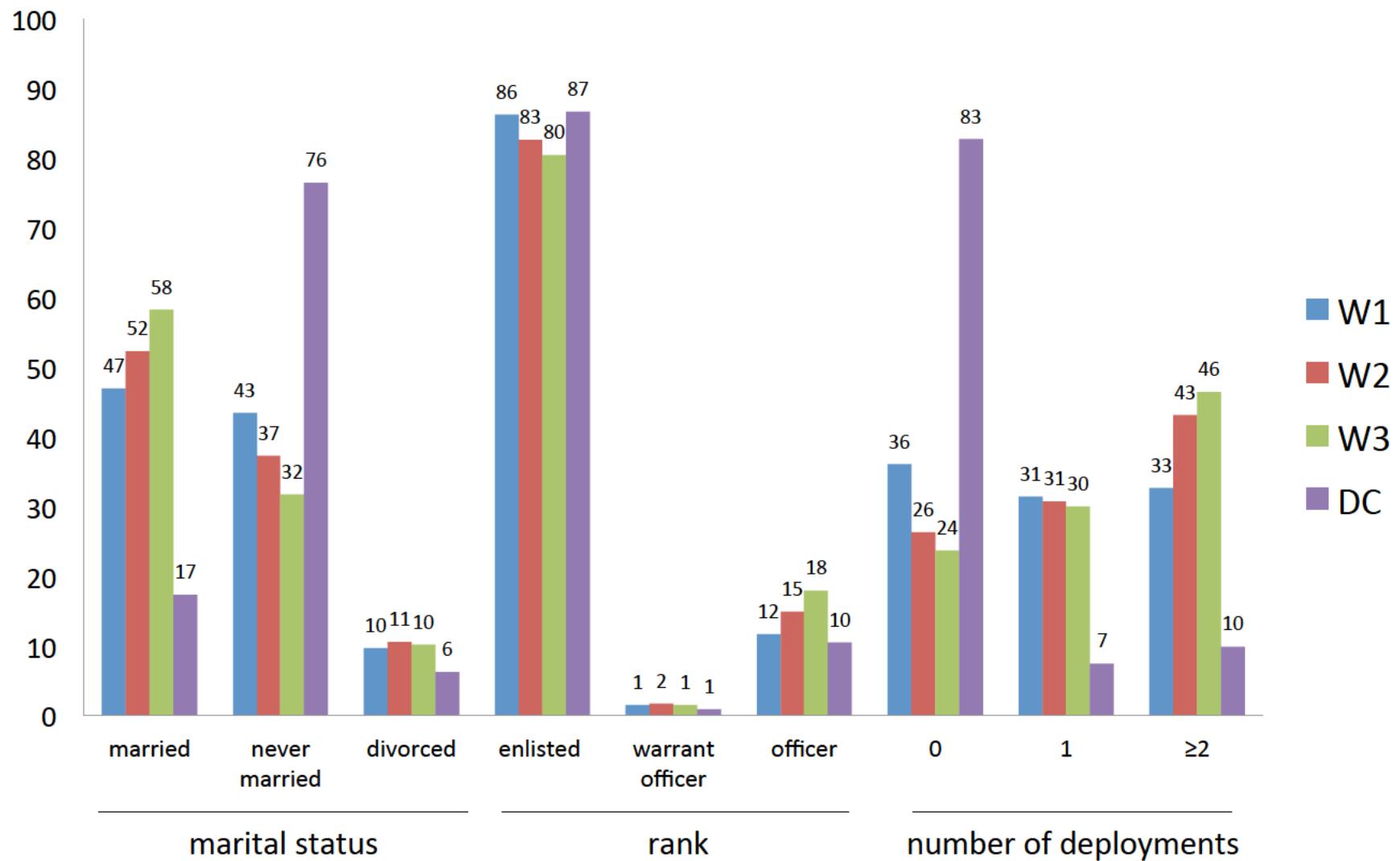
Clinical sub-sample demographics (1)
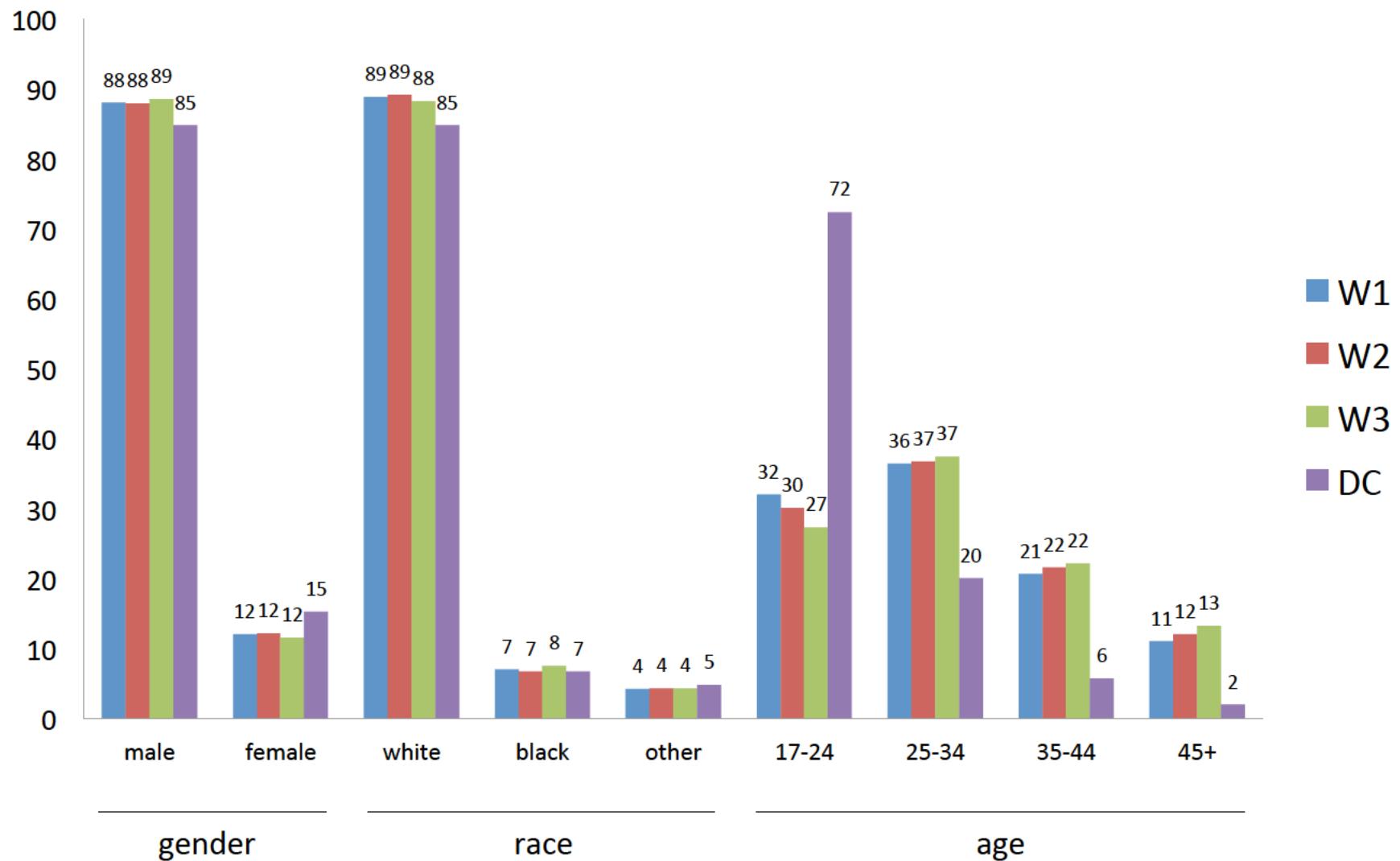
Clinical sub-sample demographics (2)
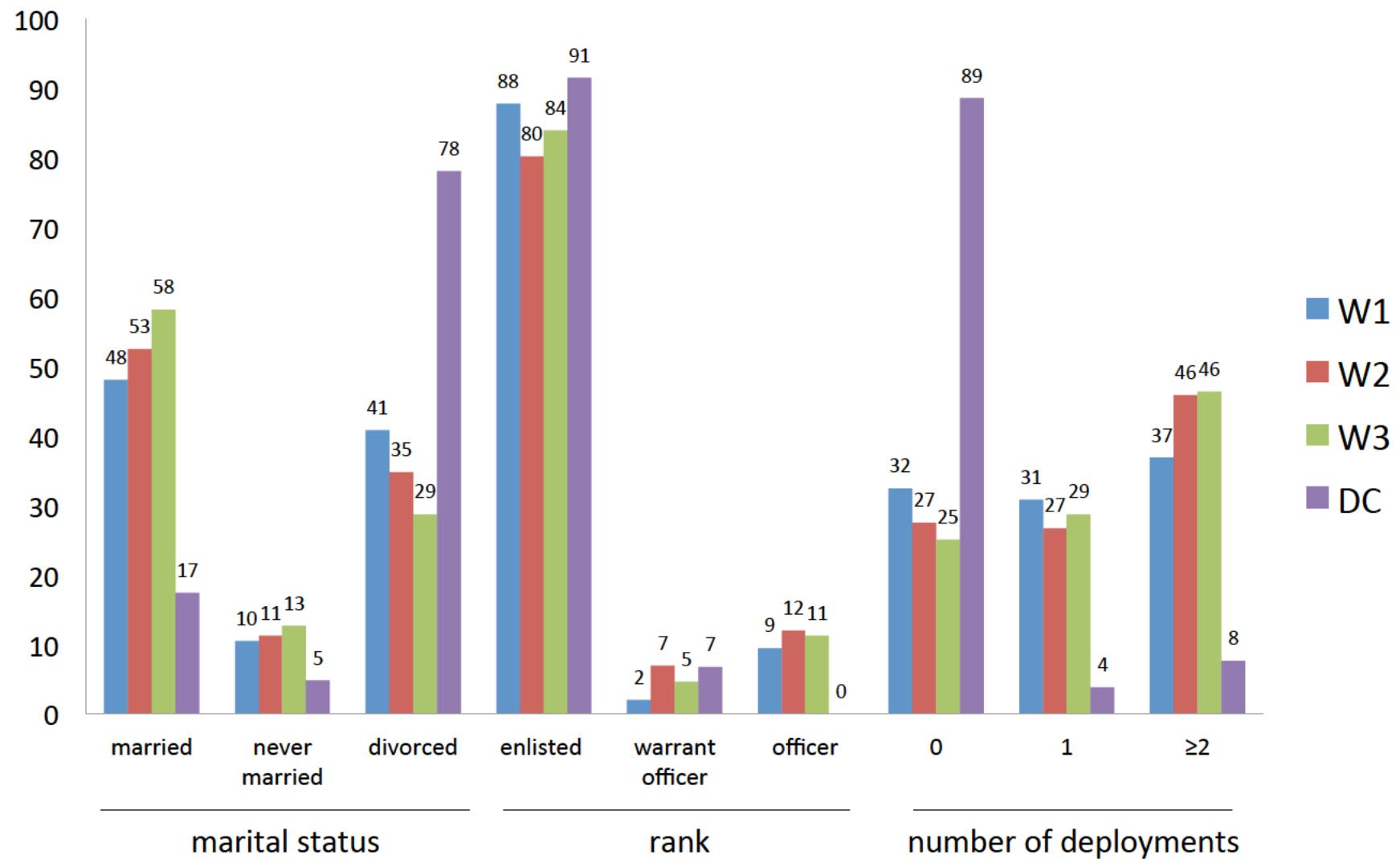
Attrition in the ONG sample to date

Attrition between waves 1 & 2

32.3%

(n=1770)

(n=846)
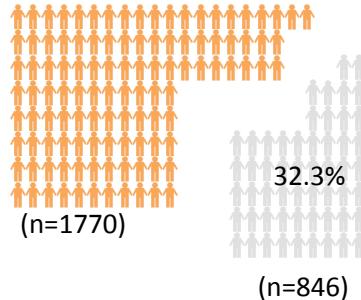
Attrition between waves 1 & 2 – was associated with:
- age
- race
- education
- marital status
- military rank

Attrition between waves 2 & 3 (to date)

34.3%

(n=1164)

(n=606)
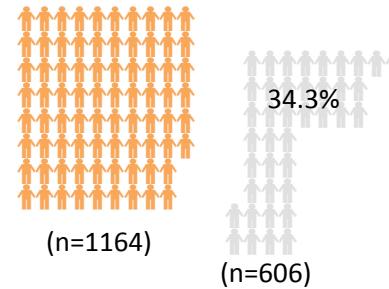
Attrition to date between waves 2 & 3 was associated with:
- age
- education
- marital status
- psychopathology

= active participant

= participant lost to follow-up

Main sample attrition between waves 1 & 2

Attrition of Wave 1

32.3%

(n=1770)

(n=846)
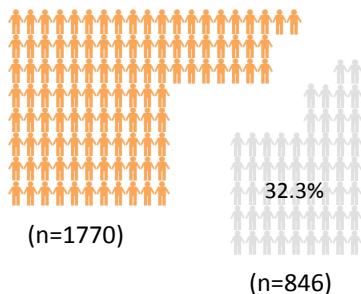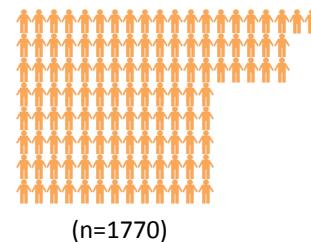
Main sample attrition between waves 1 & 2 disproportionately affected:

- 17-24 year old soldiers (lost n=324 or 36.9%)
- African American soldiers (lost n=79 or 40.5%)
- soldiers with < high school education (lost n= 289 or 39.8%)
- soldiers who were never married (lost n=417 or 36.8%)
- enlisted soldiers (n=760 or 33.4%)

Wave 2

(n=1770)

= active participant

= participant lost to follow-up

Even accounting for attrition, the DC sample will selectively augment and replenish the primary sample

Dynamic cohort will replenish the main sample with selective oversampling of:
- 17-24 year old soldiers (w1dc n=405; projected* w2dc n=355)
- African American soldiers (w1dc n=48; projected w2dc n=28)
- soldiers with < HS education (w1dc n=187; projected w2dc n=112)
- never married soldiers (w1dc n=442; projected w2dc n=230)
- enlisted soldiers (w1dc n=511; projected w2dc n=340)
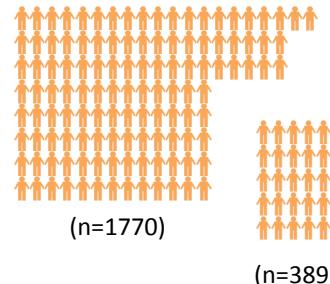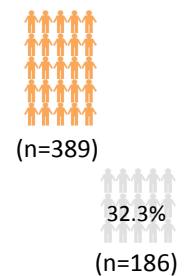
Attrition of DC*

(n=389)

32.3%

(n=186)

Wave 2

(n=1770)

(n=389)

= active participant

= participant lost to follow-up

*projections based on observed main sample attrition between waves 1 and 2

Dynamic cohort sample will allow us to maintain the composition of the original sample
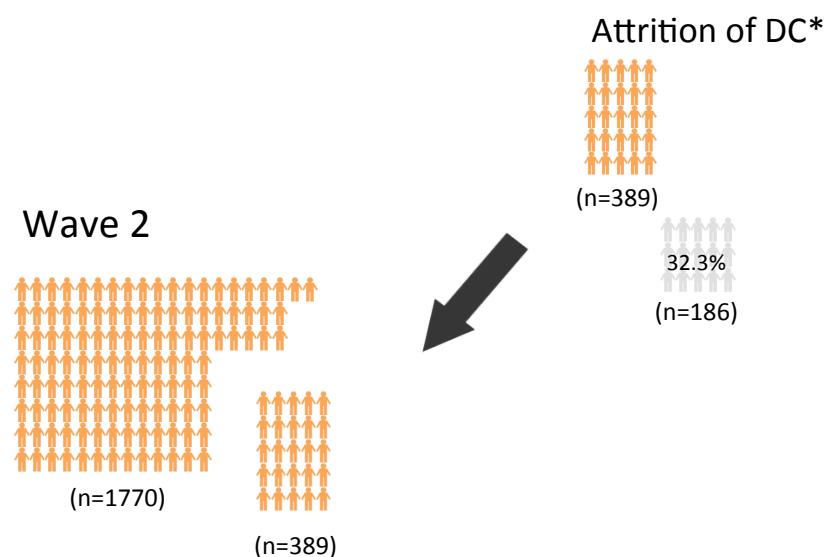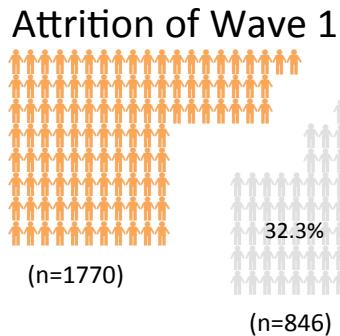
Attrition of Wave 1

32.3%

(n=1770)

(n=846)

Attrition of DC*

(n=389)

32.3%

(n=186)

Wave 2

(n=1770)

(n=389)

= active participant

= participant lost to follow-up

*projections based on observed main sample attrition between waves 1 and 2

Factors associated with main sample attrition between waves 1 and 2

age***
- 17-24: 37
- 25-34: 31
- 35-44: 31
- 45+: 22

race*
- white: 31
- black: 41
- other: 37

marital status***
- married: 28
- div/sep/wid: 33
- never married: 37

education***
- ≤ high school: 40
- some college: 31
- ≥ college degree: 27

rank**
- enlisted: 33
- civillian: 25

percent within demographic categories who
did not participate in subsequent wave
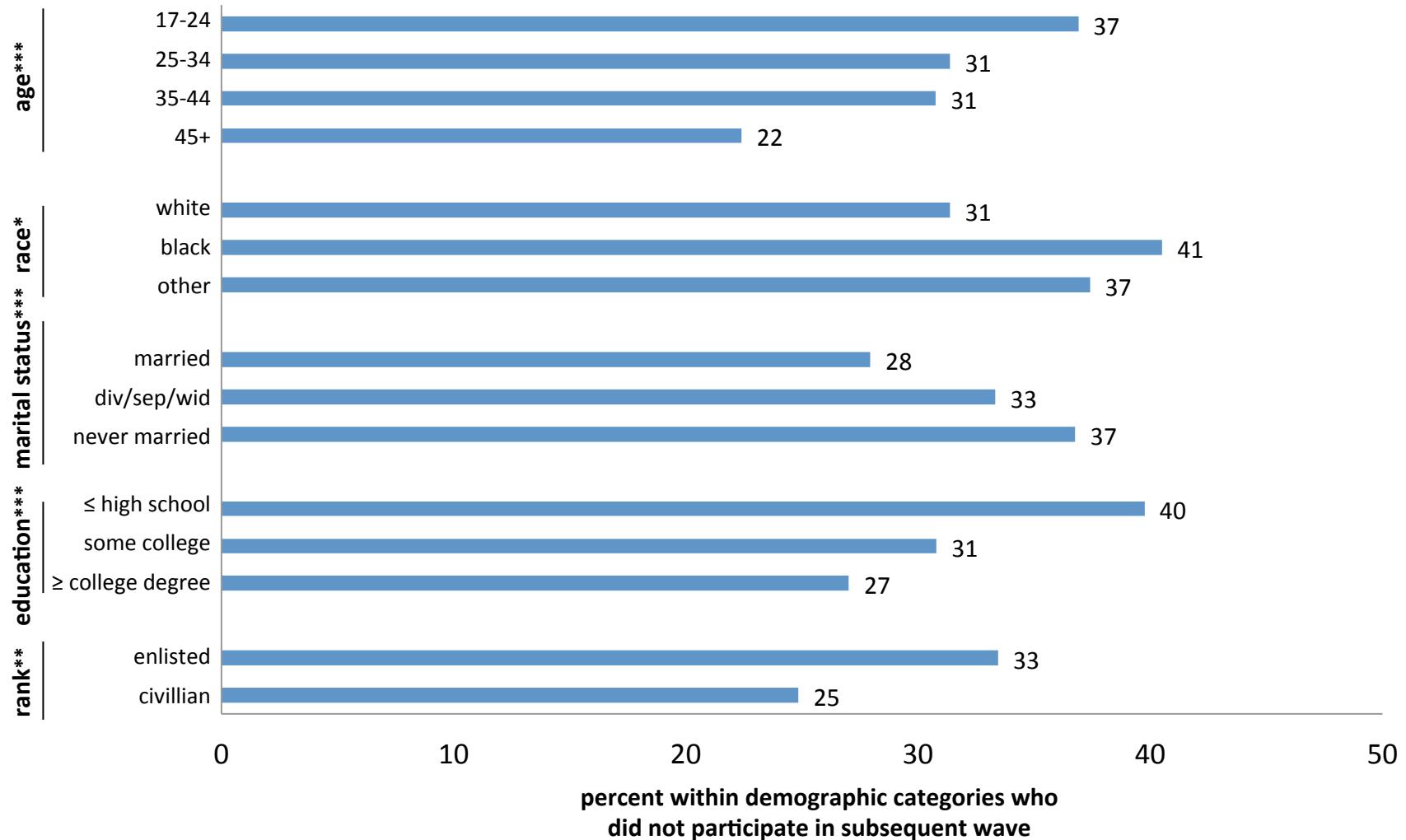
n=2616; ***p<0.001, **p<0.01, *p<0.05

Factors associated with main sample attrition between waves 2 and 3

age*
- 17-24: 42
- 25-34: 31
- 35-44: 33
- 45+: 30

marital status*
- married: 31
- div/sep/wid: 42
- never married: 36

education**
- ≤ high school: 46
- some college: 33
- ≥ college degree: 31

psychopathology*
- no: 32
- yes: 40

x-axis: 0, 10, 20, 30, 40, 50

percent within demographic categories who did not participate in subsequent wave
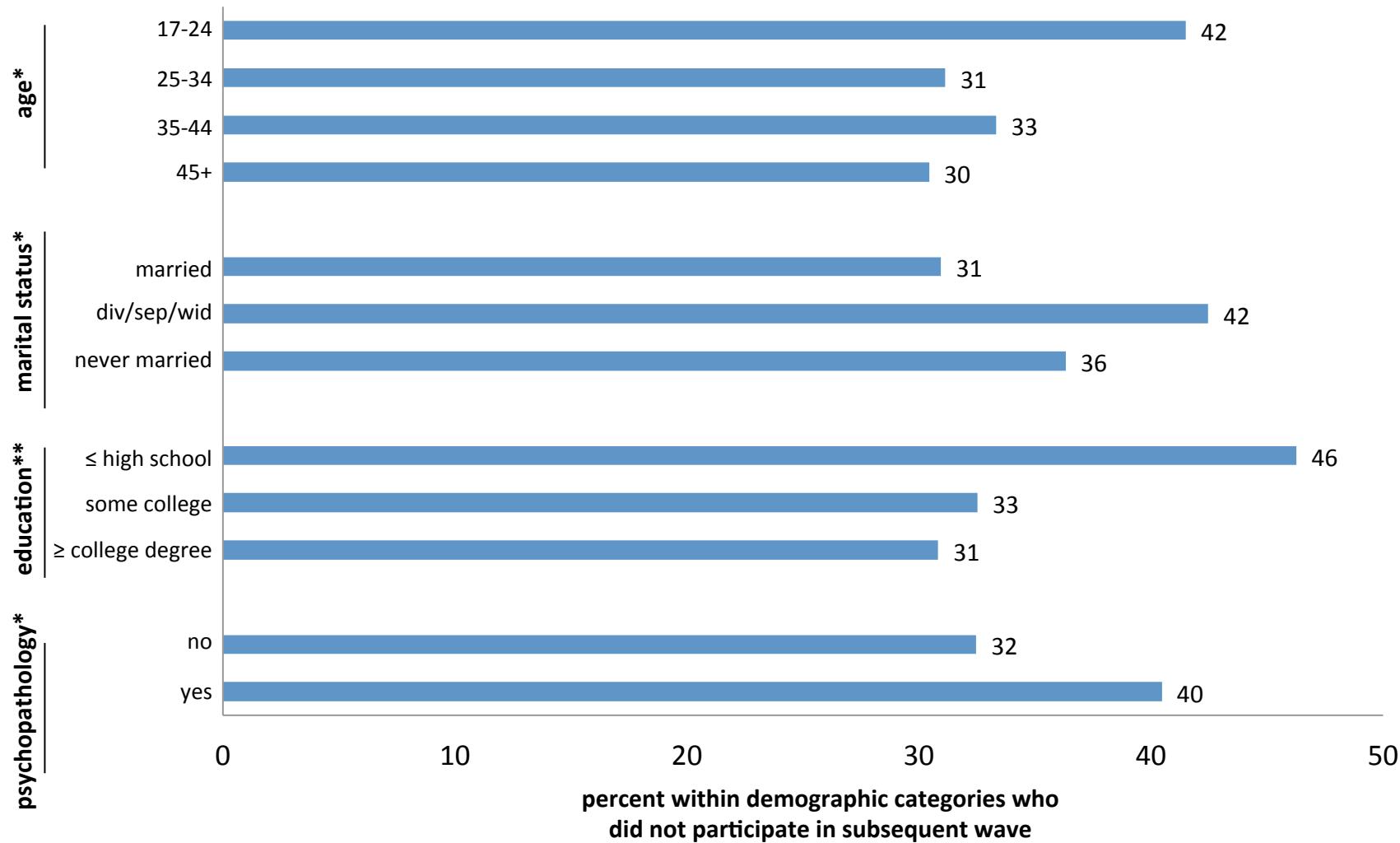
n=1770 participants who participated in wave 2; *p<0.01, **p<0.0001;
psychopathology included PTSD, depression, GAD, or an alcohol use disorder (AUD; including abuse or dependence)

Clinical subsample retention
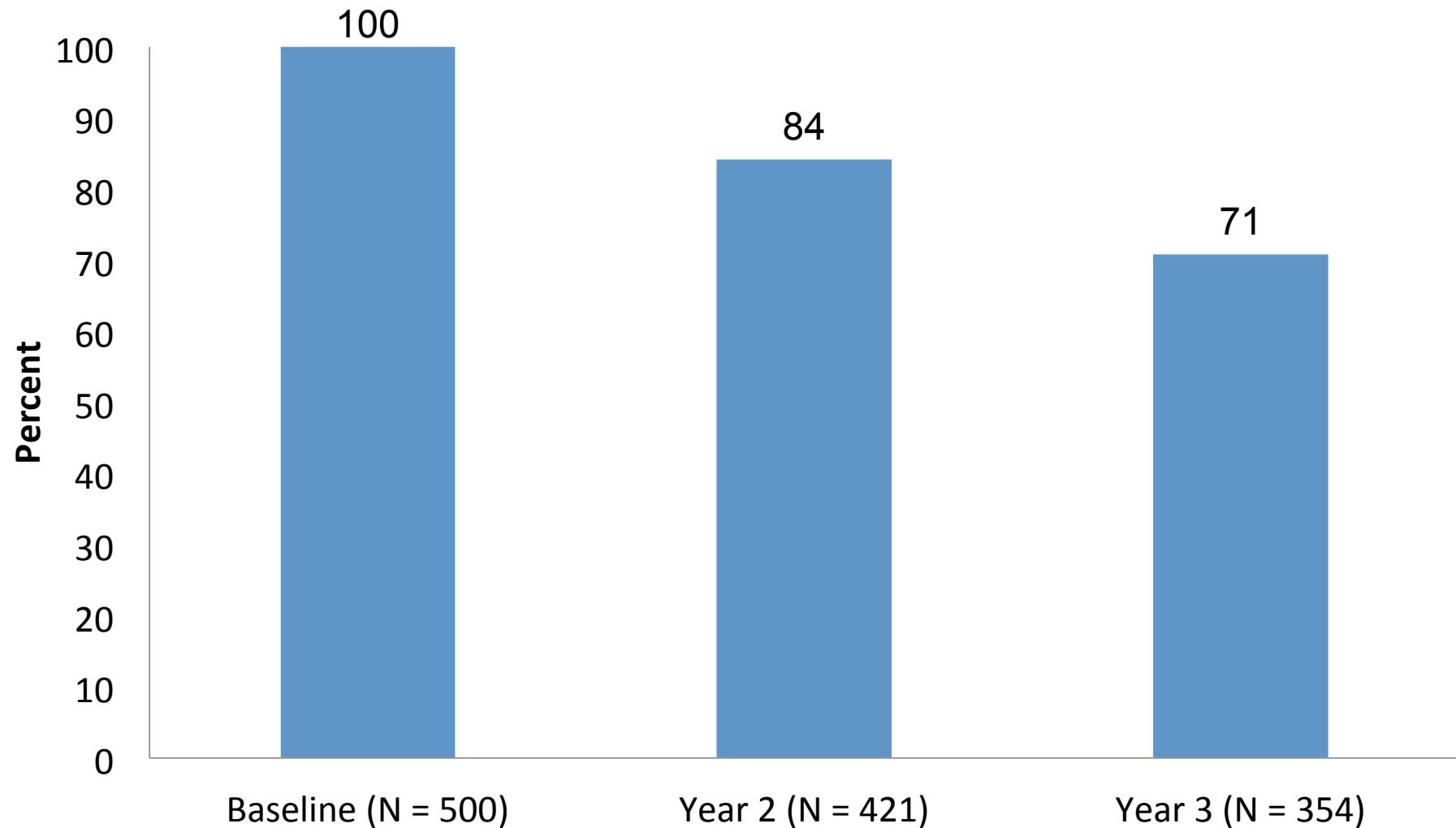
Prevalence and incidence of psychiatric disorder

Telephone sample

Lifetime prevalence of PTSD, depression, GAD, and AUD over the three years
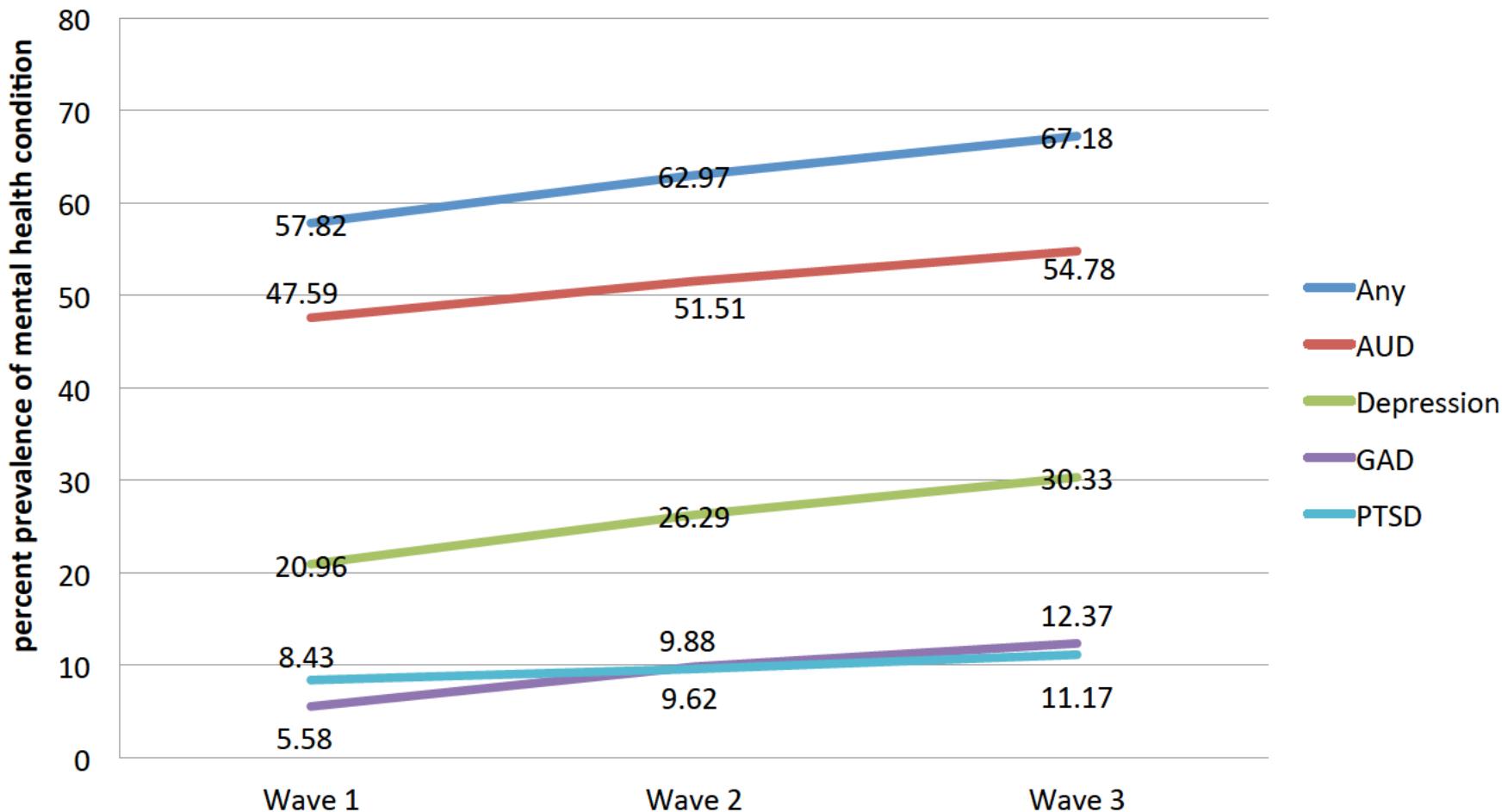
*n=1164 participants who were present for all three waves of the study

Prevalence of past-year PTSD, depression, GAD, and AUD over the three years
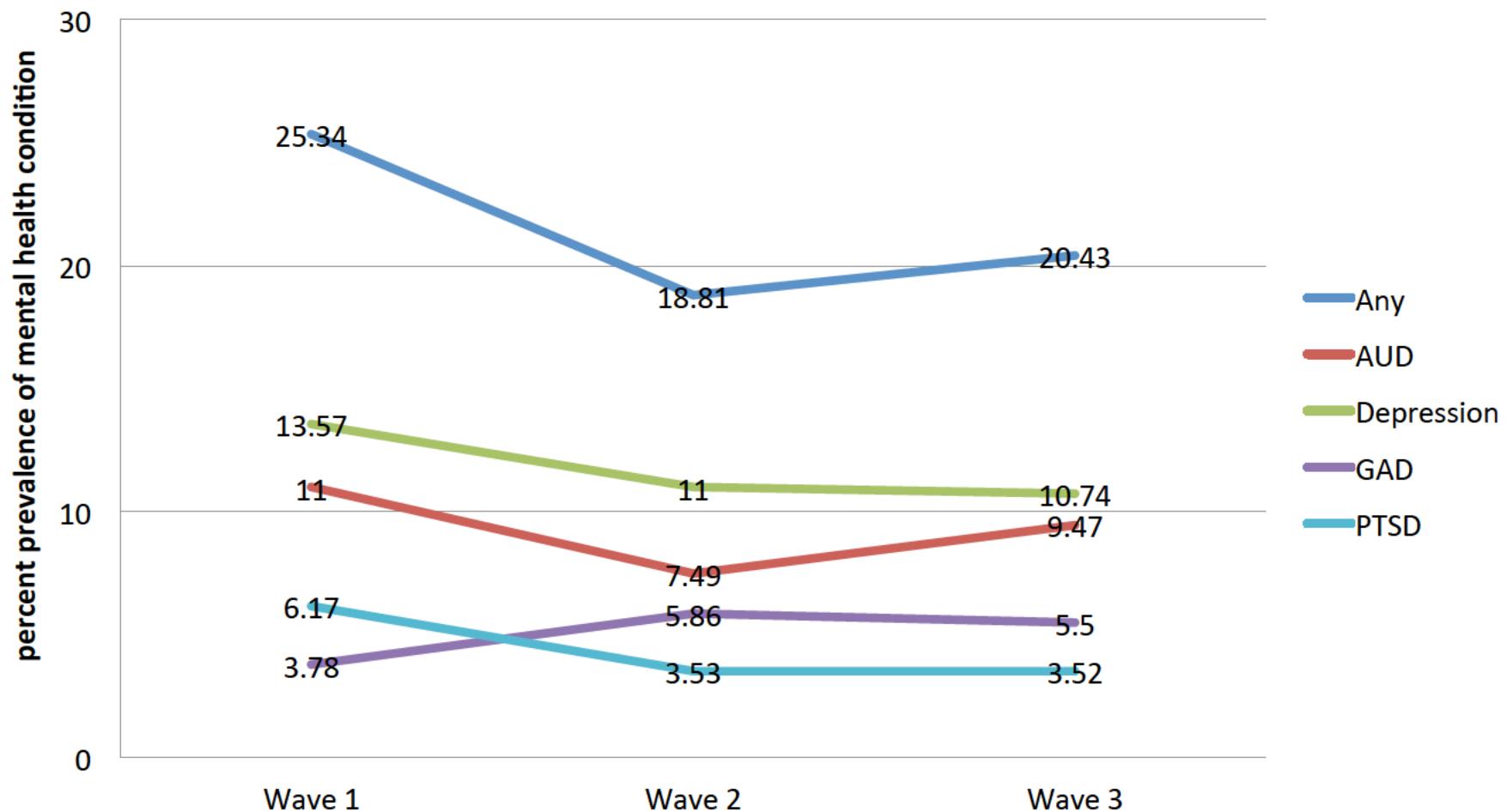
*n=1164 participants who were present for all three waves of the study

Cumulative incidence of mental health disorders over two years
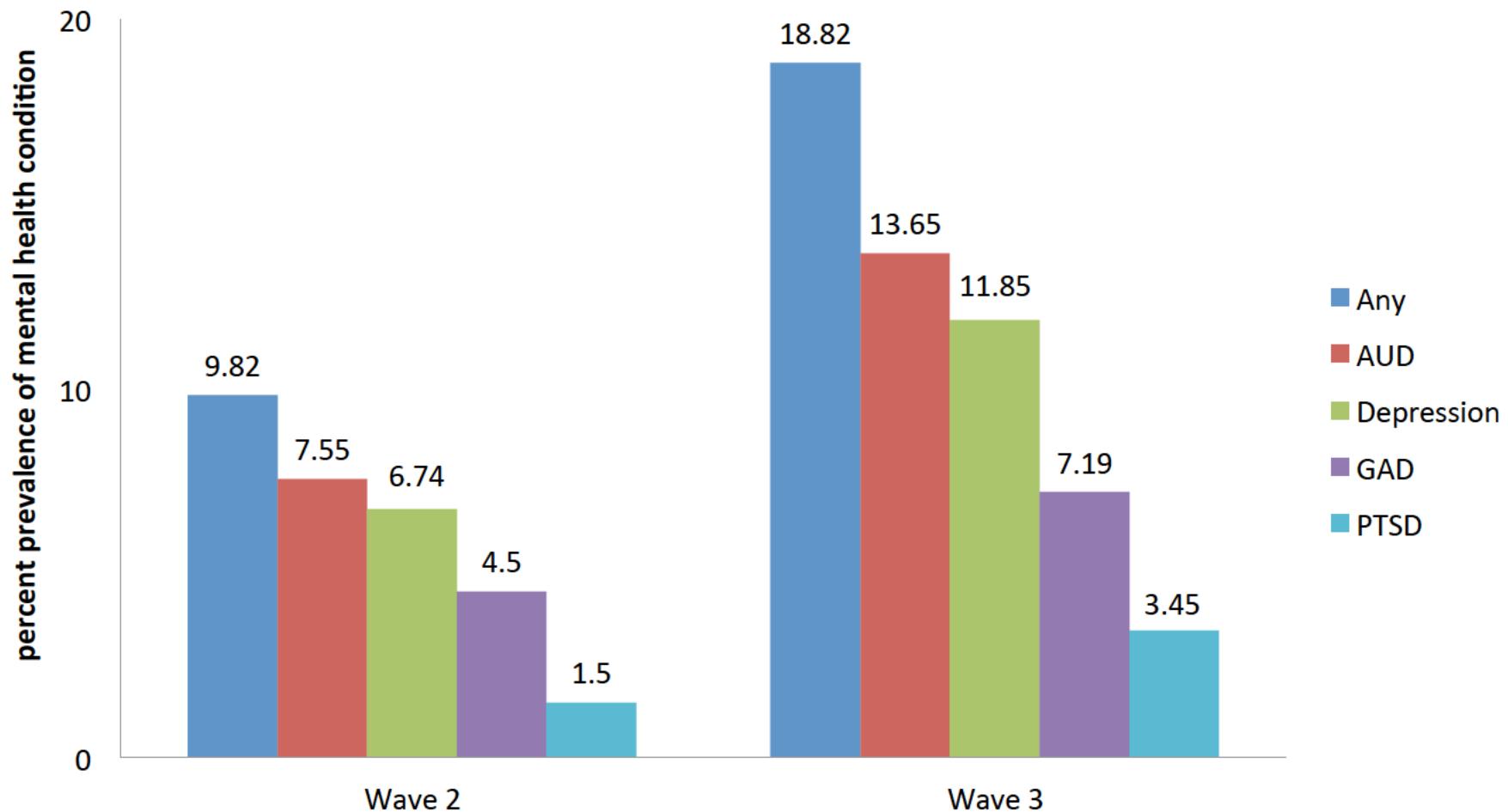
*n=491 participants who did not have a mental health disorder at baseline and were present for all three waves of the study

Clinical sub-sample

Baseline lifetime prevalence per 100 people (1)

Disorder	Cases per 100 people
Alcohol Abuse	28.8
Major Depressive Disorder	22.8
Alcohol Dependence	20.4
Cannabis Abuse	8.6
PTSD	6.8
Social Phobia	6.2
Generalized Anxiety	5.0
Cannabis Dependence	4.6
Specific Phobia	4.4
Panic Disorder	4.2

Cases per 100 people

N = 500, Clinical Subsample

Baseline lifetime prevalence per 100 people (2)

Disorder	Cases per 100 people
Obsessive Compulsive	3.8
Agoraphobia without Panic	3.8
Adjustment Disorder	3.4
Bipolar I	2.8
Depressive Disorder	2.0
Opiod Abuse	1.8
Cocaine Abuse	1.4
Dysthymic	1.4
Cocaine Dependence	1.2
Stimulant Abuse	1.2
Bipolar II	1.2
Anorexia	1.0

Cases per 100 people

N = 500, Clinical Subsample

Baseline lifetime prevalence per 100 people (3)

Cases per 100 people

Disorder	Cases per 100 people
Anorexia	1
Anxiety Disorder NOS	1
Sedative Abuse	1
Hallucinogen Abuse	0.8
Opiod Dependence	0.8
Stimulant Dependence	0.6
Other Bipolar Disorder	0.6
Bulimia	0.4
Other Drug Abuse	0.4
Hallucinogen Dependence	0.4
Substance Induced Mood Disorder	0.4
Body Dysmorphic Disorder	0.2
Hypochondriasis	0.2
Binge Eating	0.2
Other Drug Dependence	0.2
Sedative Dependence	0.2
Psychotic Symptoms	0.2
Mood Disorder due to GMC	0.2

N = 500, Clinical Subsample

Wave 2 incidence rate per 100 people

Disorder	Cases per 100 people
Alcohol Abuse	5.8
Specific Phobia	2.2
Agoraphobia without Panic	2.2
Generalized Anxiety Disorder	2
Adjustment Disorder	1.4
Anxiety Disorder NOS	1.4
Alcohol Dependence	1.4
Major Depressive Disorder	1.4
Panic Disorder	1
Social Phobia	0.8
Binge Eating	0.6
Obsessive Compulsive Disorder	0.6
PTSD	0.6
Cannabis Abuse	0.4
Psychotic Symptoms	0.4
Dythymic Disorder	0.4
Body Dysmorphic Disorder	0.2
Other Drug Dependence	0.2
Hallucinogen Abuse	0.2
Stimulant Dependence	0.2
Bipolar II	0.2

Cases per 100 people

N = 421, Clinical Subsample

Trajectories of PTSD
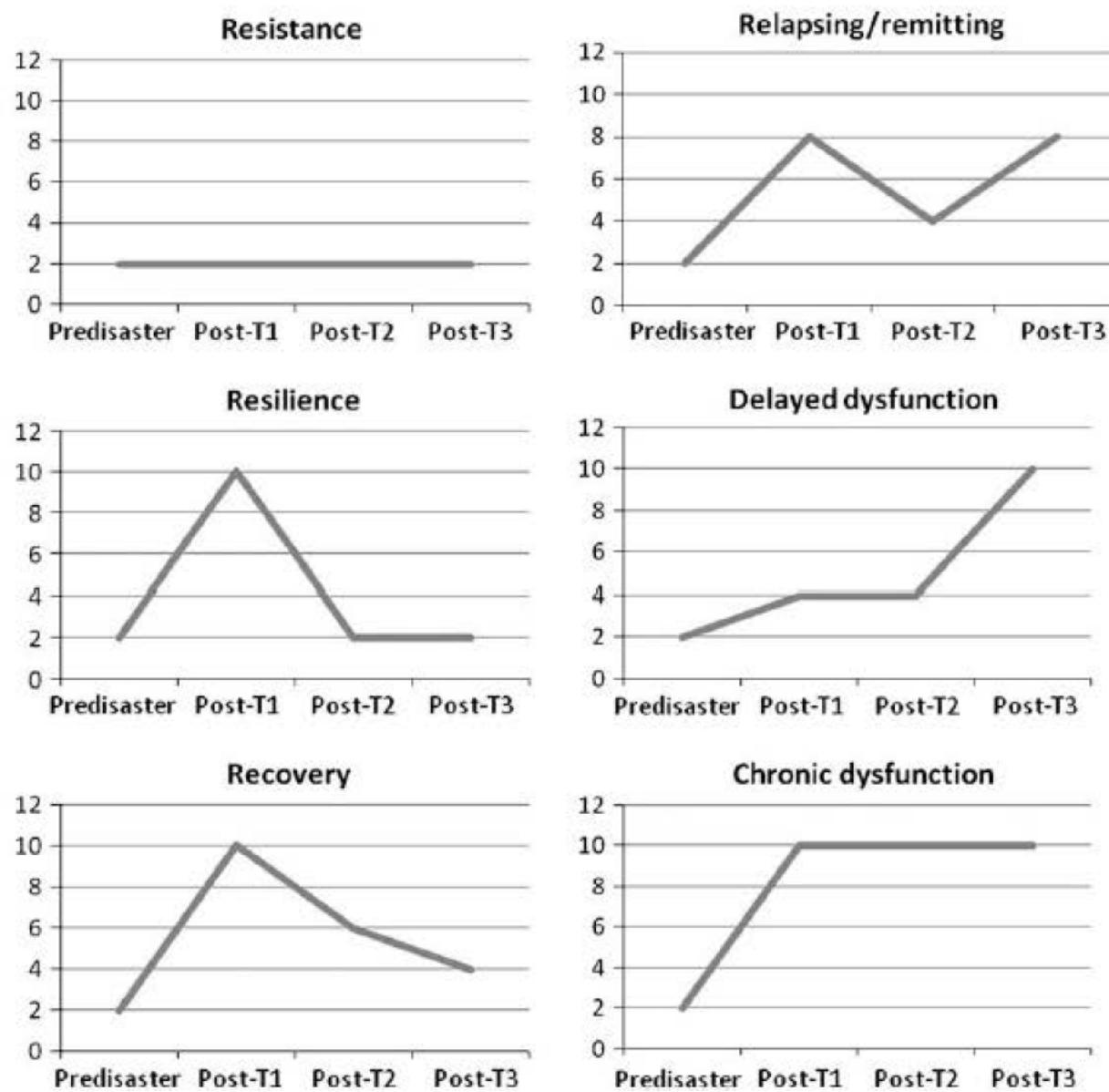
Fig. 1. Hypothesized trajectories of the course of stress responses.

Norris et al., 2009

Trajectories of PTSD over 3 years (1)

Wave 1

Wave 2

Wave 3
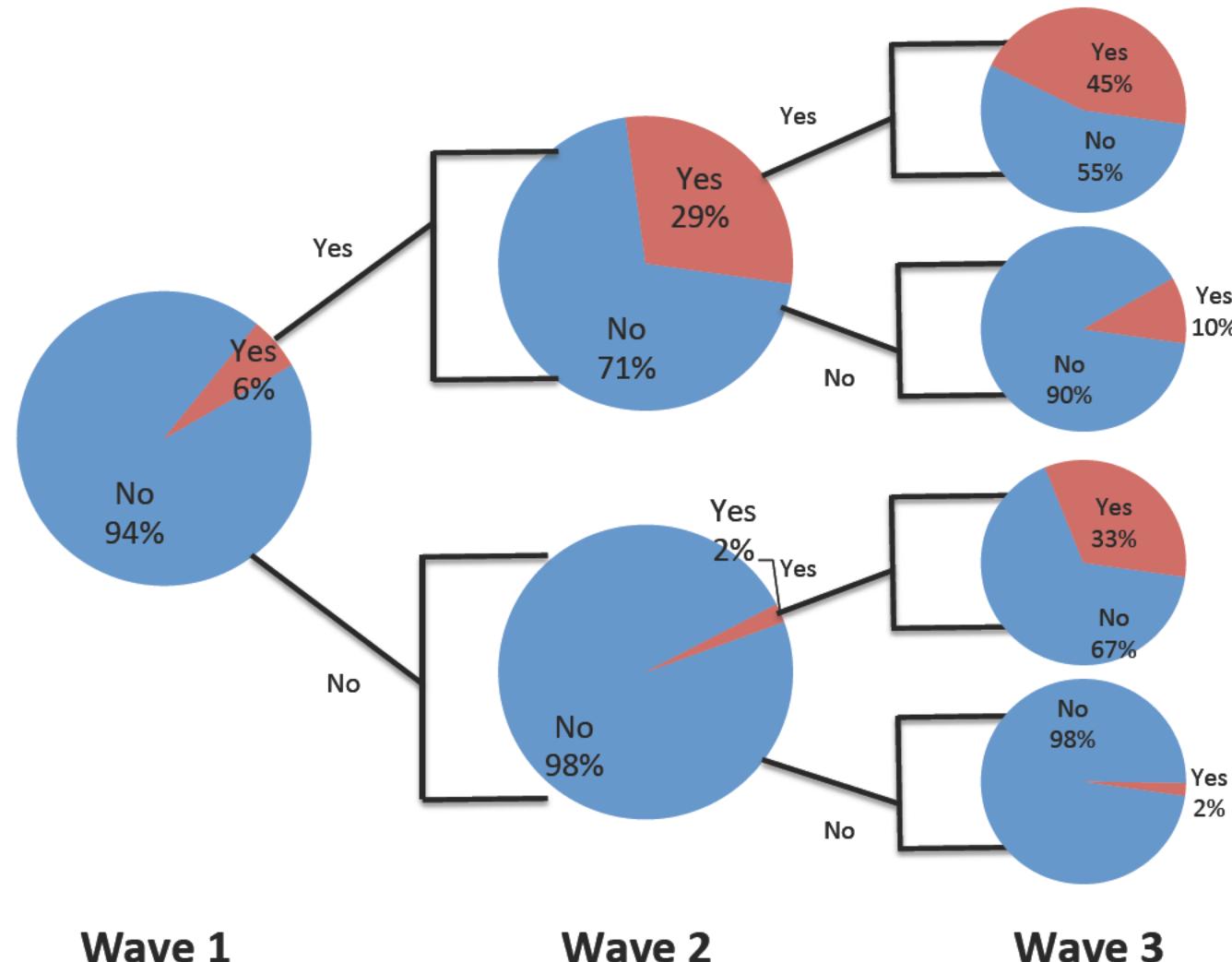
*n=1103 who reported having had at least 1 lifetime traumatic event at wave 1

Mental health service utilization

Mental health need and 1-year prevalence of service utilization among the ONG

mental health service need at wave 2

yes
17%
(n=218)

no
83%
(n=1101)
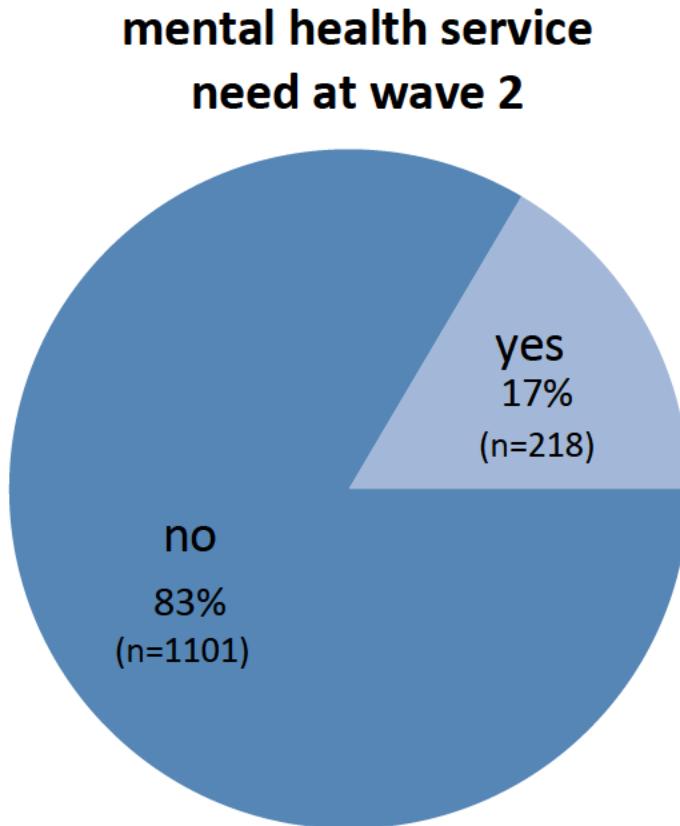
(N=1319)

mental health service use among those with need between waves 2 & 3

yes
37%
(n=81)

no
63%
(n=137)
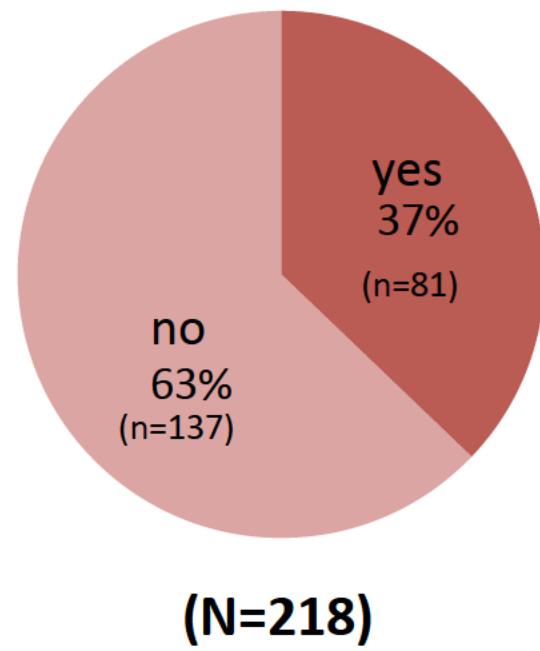
(N=218)

*mental health need was defined as ≥ 1 mental health disorder, including PTSD, depression, GAD, or an alcohol use disorder (AUD; including abuse or dependence), or past month suicidal ideation

1-year prevalence of tricare or VA mental health service utilization among the ONG

any use of mental health services between waves 2 & 3

yes
37%
(n=81)

no
63%
(n=137)
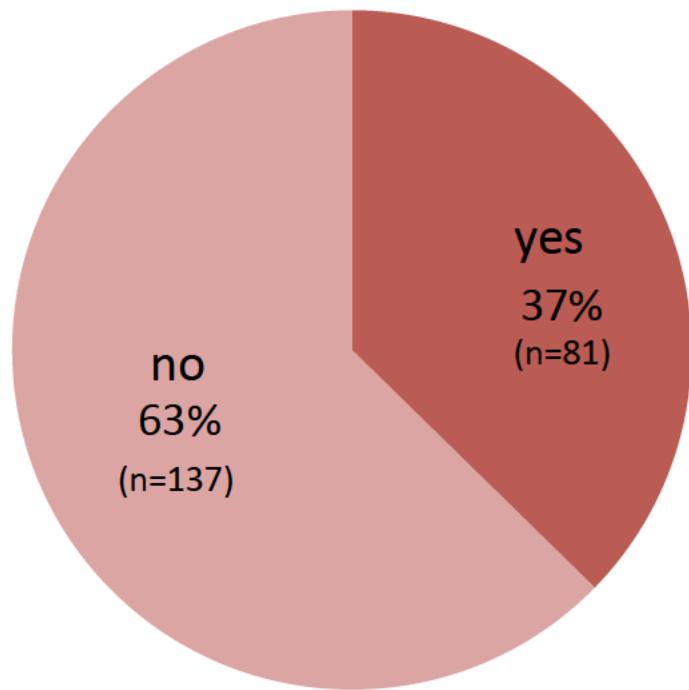
(N=218)

military/VA mental health service use among those with need between waves 2 & 3

no
42%
(n=34)

yes
58%
(n=47)
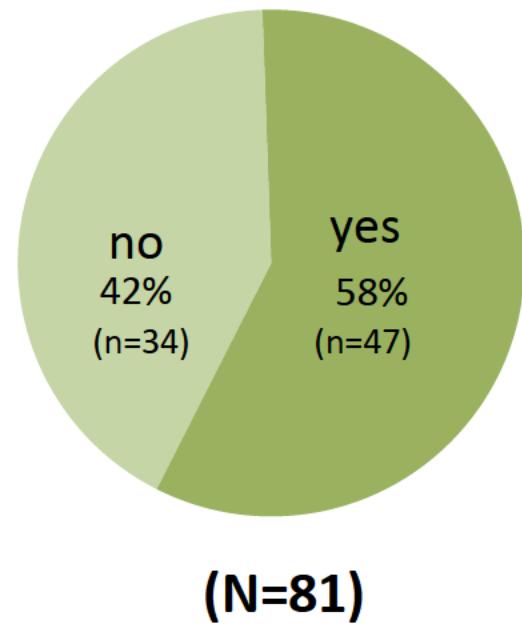
(N=81)

*mental health need was defined as ≥ 1 mental health disorder, including PTSD, depression, GAD, or an alcohol use disorder (AUD; including abuse or dependence), or past month suicidal ideation

Utilization of mental health services by psychiatric disorder
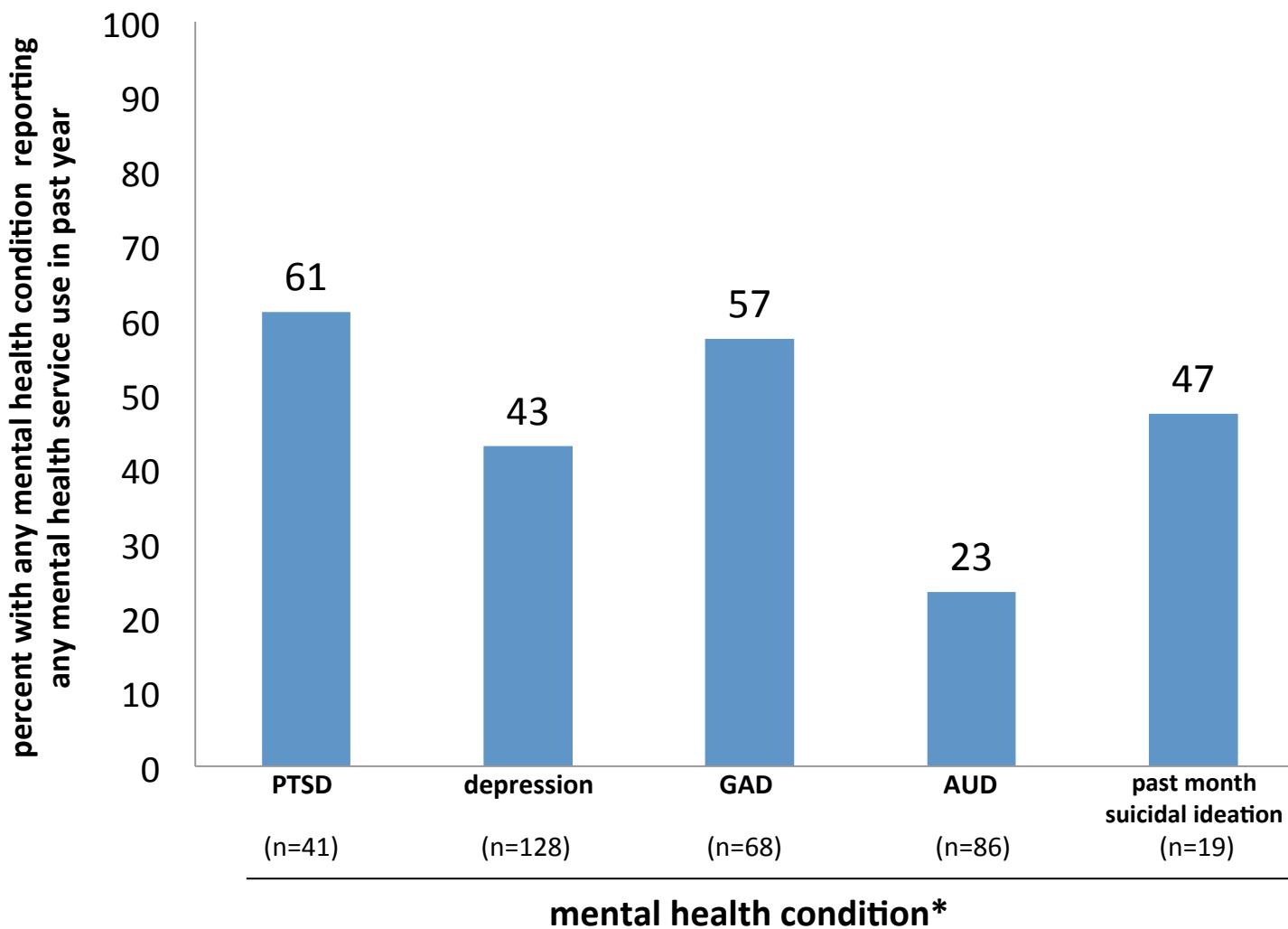
*n=218

Greater psychiatric burden was associated with higher utilization of mental health services
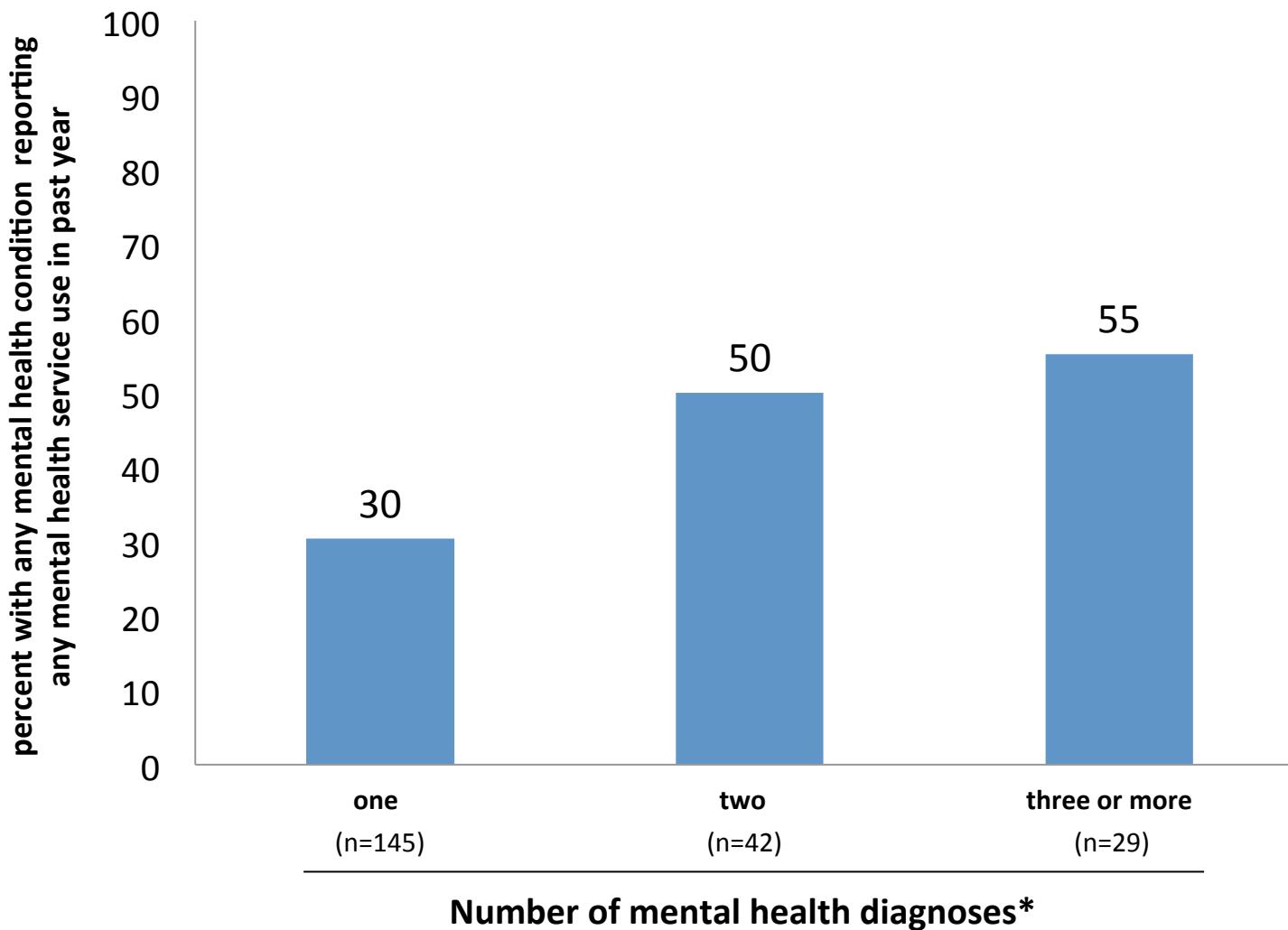
*n=218; p<0.01; mental health diagnoses included PTSD, depression, GAD, or an alcohol use disorder (AUD; including abuse or dependence)

Race and education were associated with any use of mental health services

percent with any mental health condition* reporting any mental health service use in past year

race*			education*		
white (n=197)	black (n=10)	other (n=11)	≤ high school (n=27)	some college (n=127)	≥ college degree (n=46)
35	70	55	59	33	33
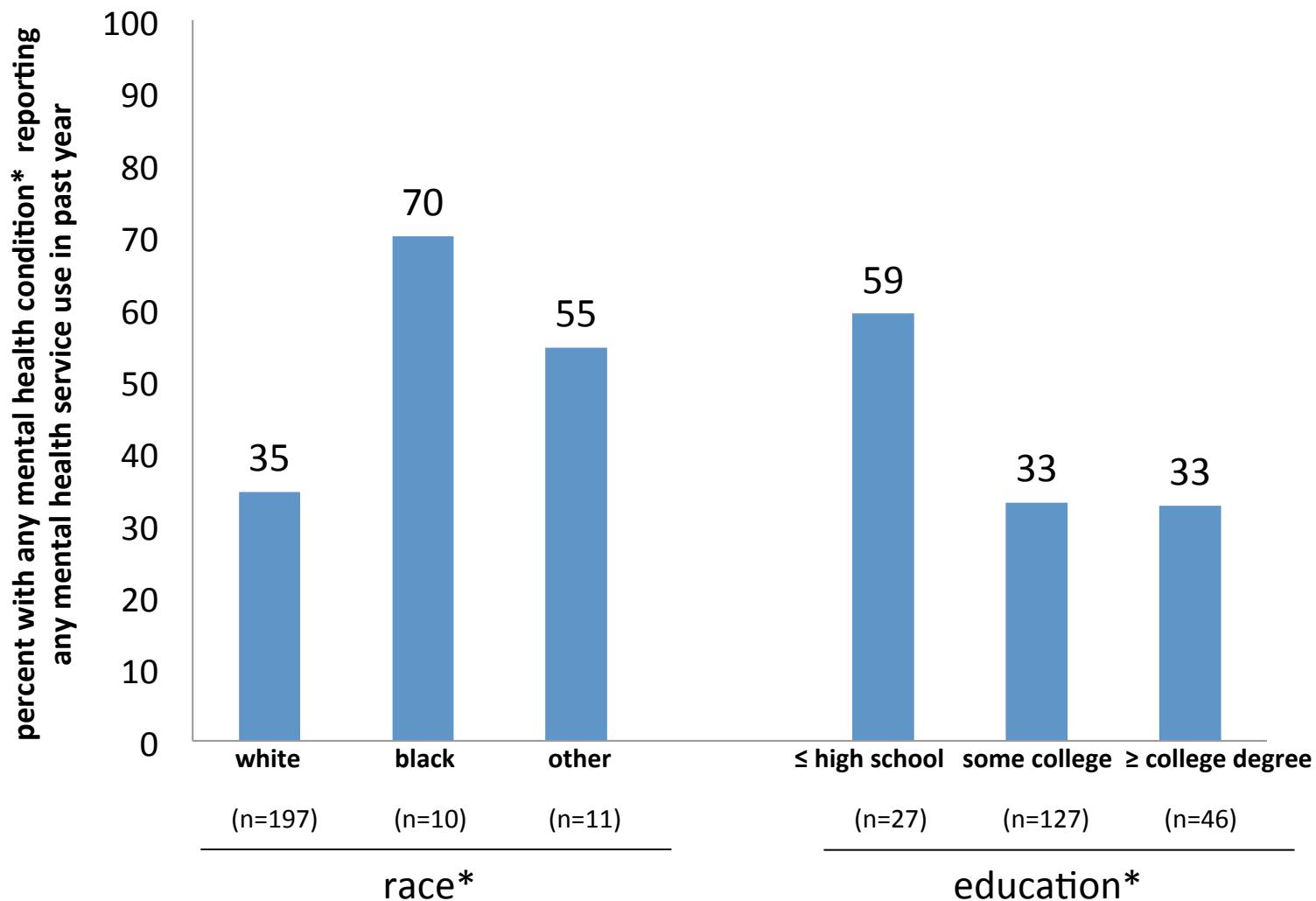
*p<0.05; n=215; mental health conditions included PTSD, depression, GAD, an alcohol use disorder (AUD; including abuse or dependence), or past month suicidal ideation

Gender was not associated with use of any mental health services or use of VA/DoD services
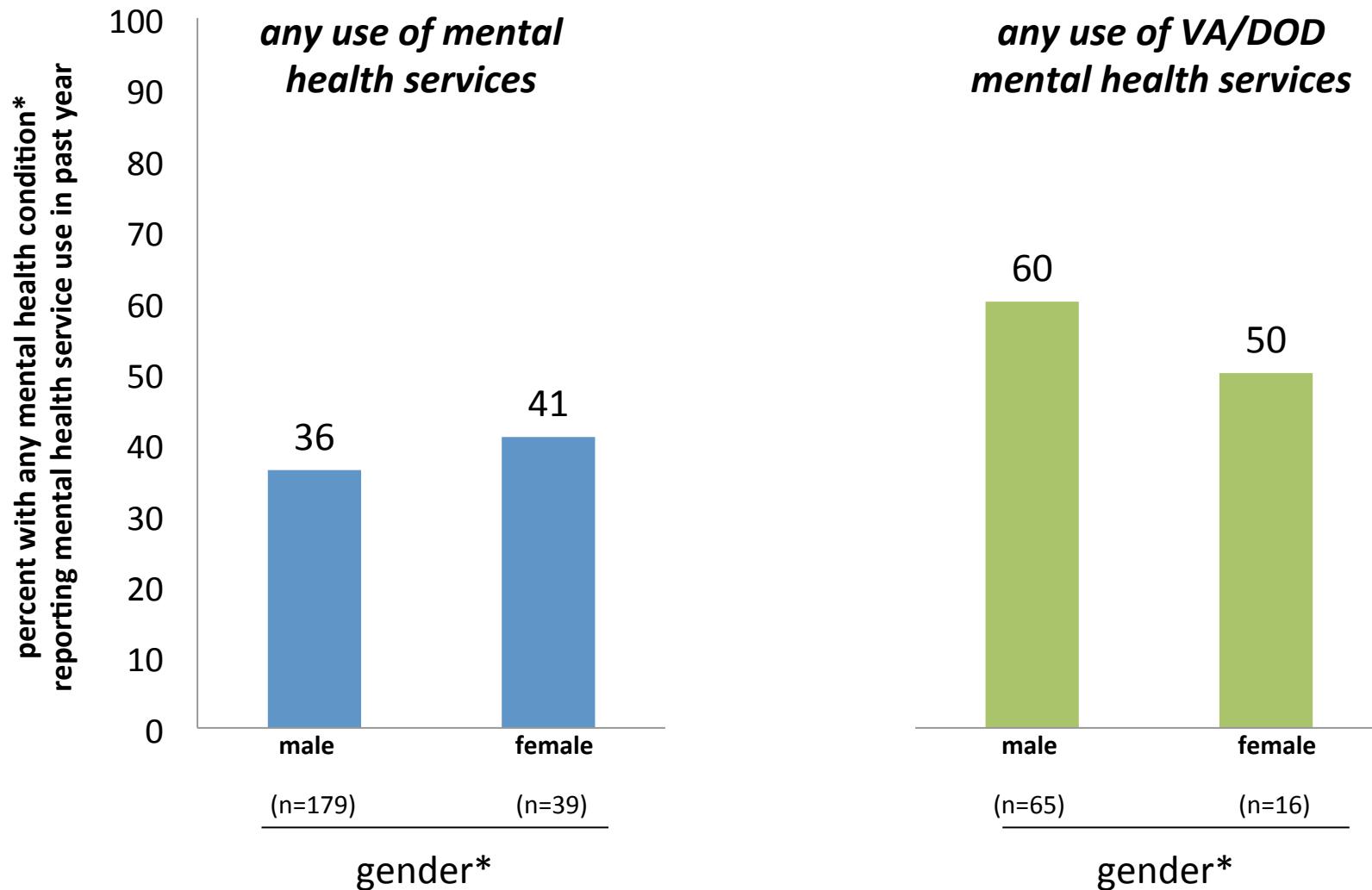
*neither comparison was statistically significant; n=215; mental health conditions included PTSD, depression, GAD, an alcohol use disorder (AUD; including abuse or dependence), or past month suicidal ideation

Age was associated with use of VA/DoD services
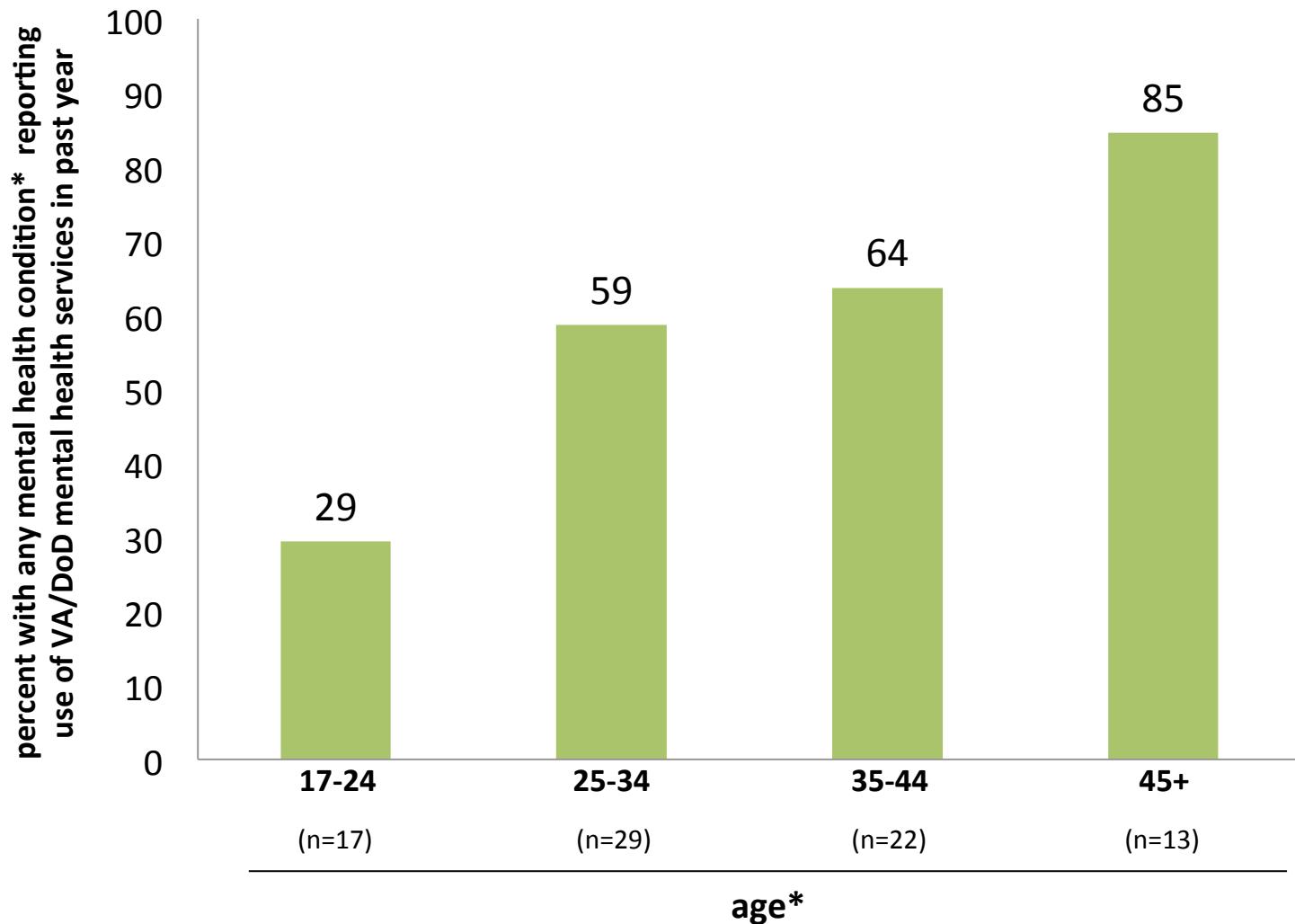
*n=81; p<0.05; mental health conditions included PTSD, depression, GAD, an alcohol use disorder (AUD; including abuse or dependence), or past month suicidal ideation

Conclusions

- the majority of ONG soldiers who have mental health care need do not report accessing services

- greater psychiatric burden was associated with higher utilization of mental health services

- alcohol use disorder by far most common reported psychopathology

- those with AUD also least likely to use mental health services

- a little over half of those who access care report utilizing VA or DoD services

- the youngest group of veterans were least likely to use VA/DoD services

Risk-taking behaviors in the Ohio Army National Guard

Deployment and risky driving behavior

Study aim

To investigate the impact of pre-, peri-, and post-deployment factors and psychopathology on risk-taking behaviors in a representative sample of Ohio Army National Guard soldiers.

Why examine risk-taking behavior in soldiers?

- deployment-related traumatic events are linked to a propensity for risk-taking (Killgore et al., 2008)

- deployment may lead to some types of risky driving due to a persistence of learned driving behaviors that are normative in deployment settings but potentially dangerous in civilian settings (Fear et al., 2008)

- few studies have examined risky behavior in this population

Risk-taking behaviors of interest

- driving behavior (within past 30 days)
  - drinking and driving
  - passing on the right
  - ignoring speed limits

(Manchester driver behavior questionnaire, 2006)

Among all participants, approximately one quarter reported at least one risky driving behavior
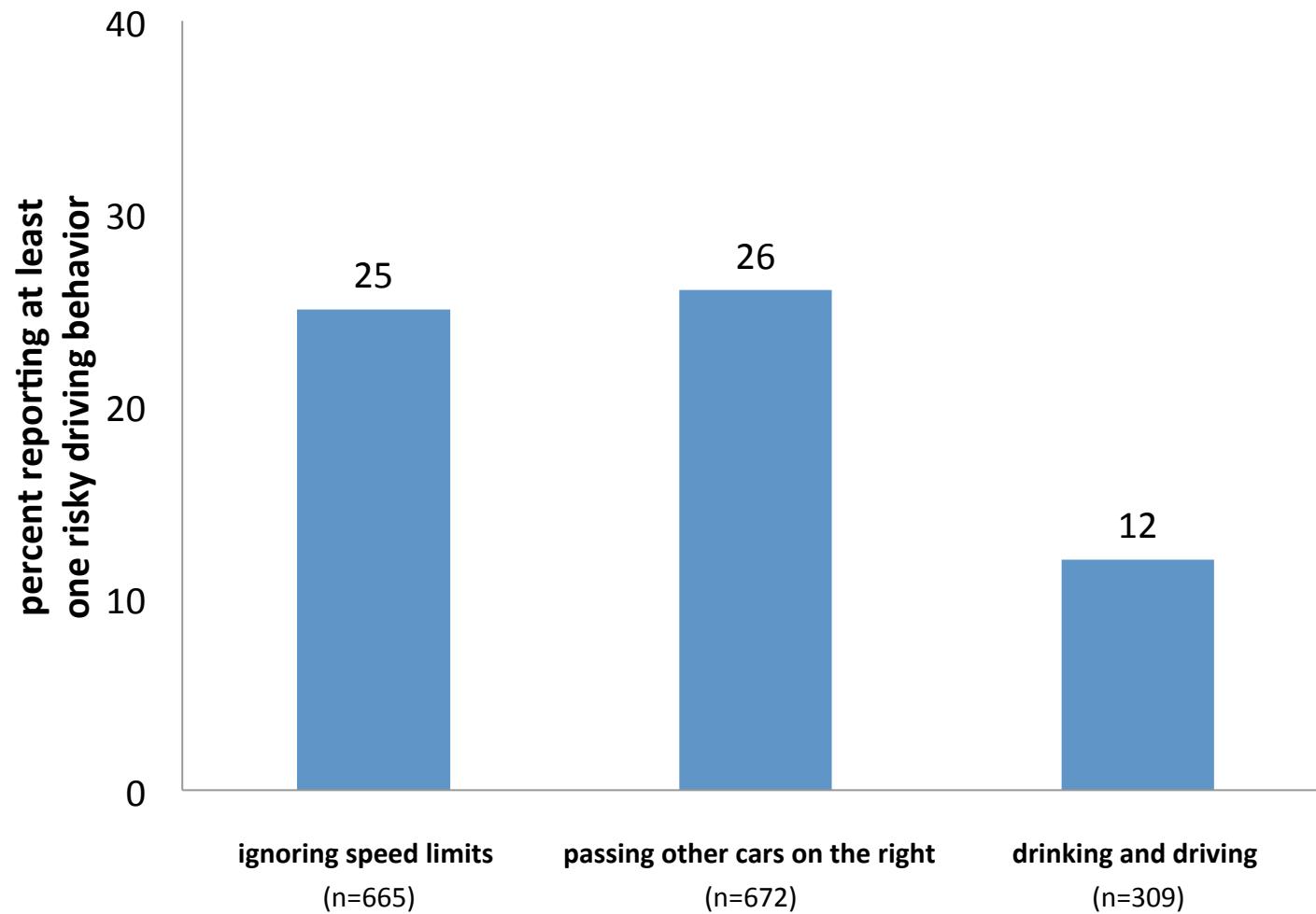
n=2616; in national sample, approximately 2% reported drinking and driving within past 30 days (Bergen et al., 2012)

Conflict area deployment was associated with risky driving behavior*
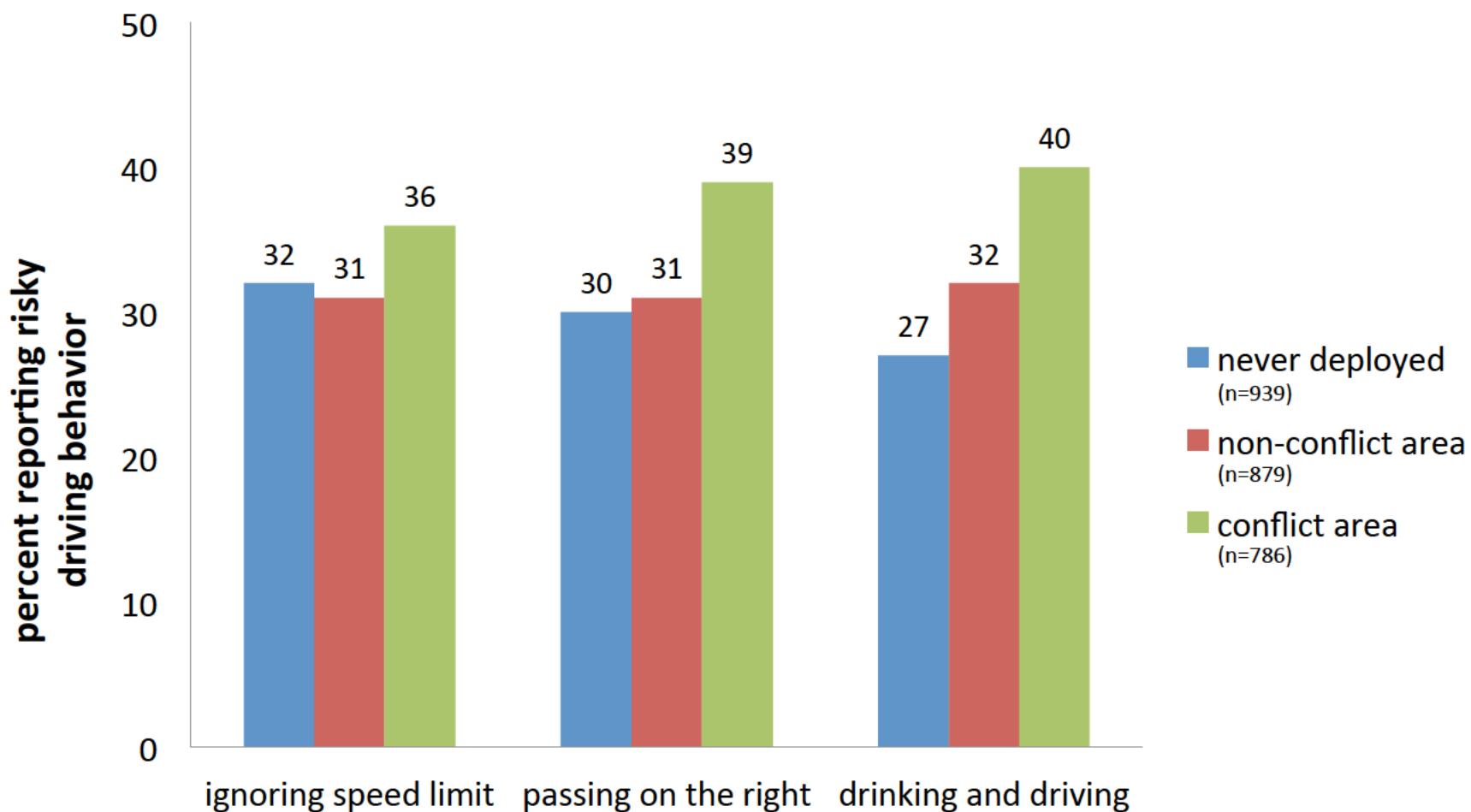
*n=2616; all comparisons significant at p<0.01

Being deployed to a conflict area was associated with all types of risky driving behavior
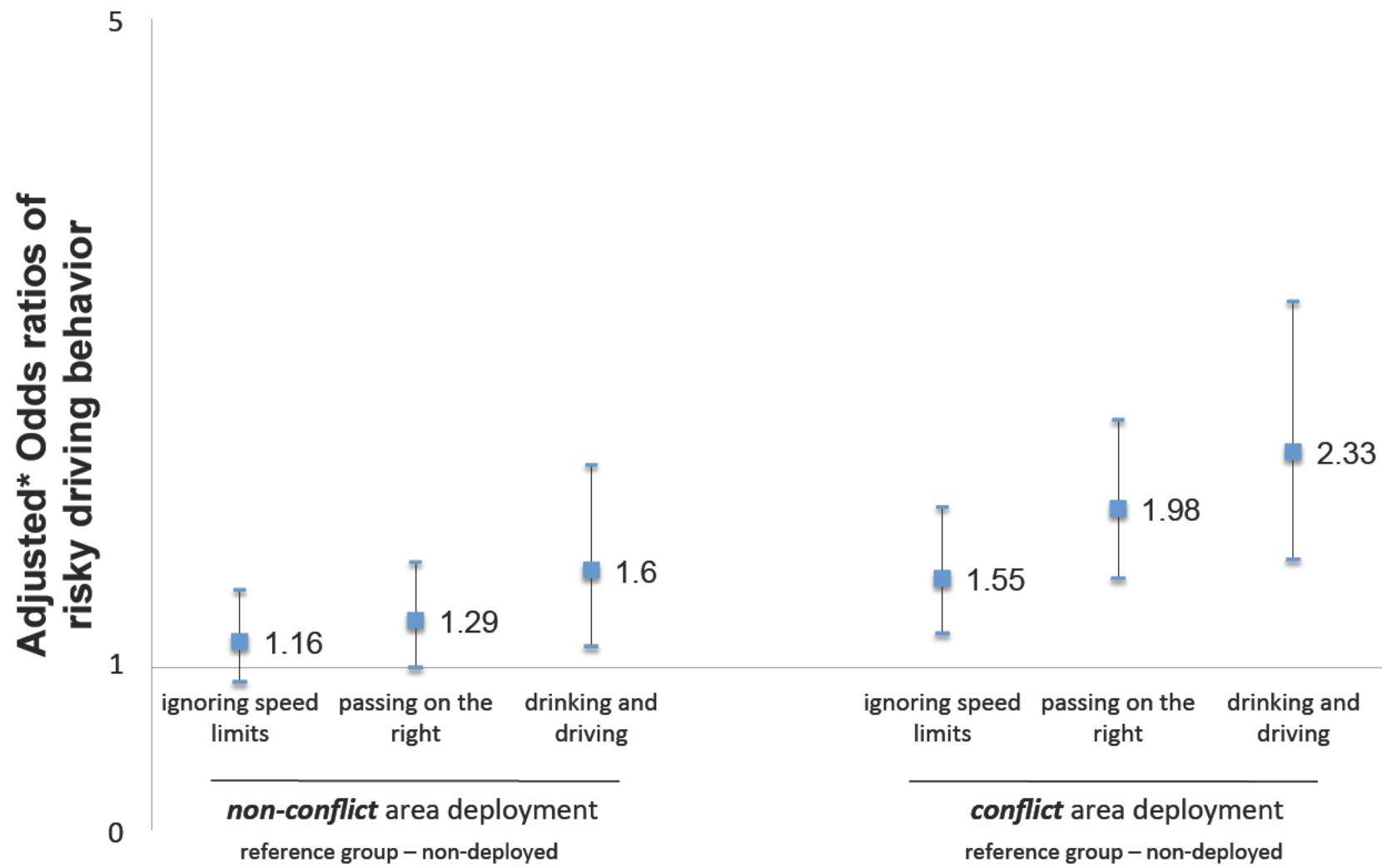
Adjusted* Odds ratios of risky driving behavior

non-conflict area deployment
reference group – non-deployed

conflict area deployment
reference group – non-deployed

1.16 — ignoring speed limits
1.29 — passing on the right
1.6 — drinking and driving
1.55 — ignoring speed limits
1.98 — passing on the right
2.33 — drinking and driving

*n=2616; results adjusted for gender, age, race, income, education, marital status and deployment

Dose-response between number of deployment traumas and risky driving
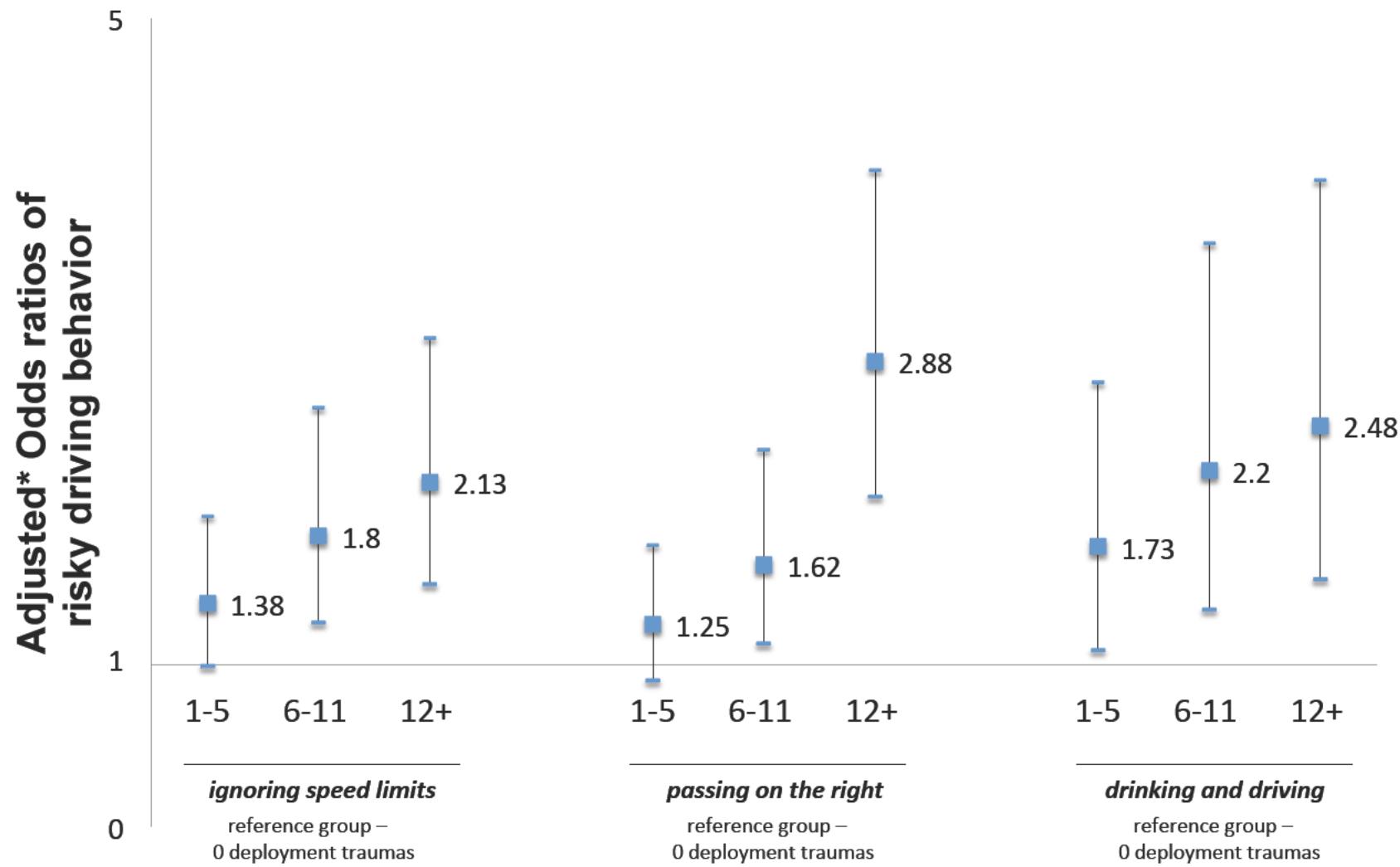
*n=2616; results adjusted for gender, age, race, income, education, marital status and deployment

Several peri-deployment stressors were associated with increased odds of risky driving behavior
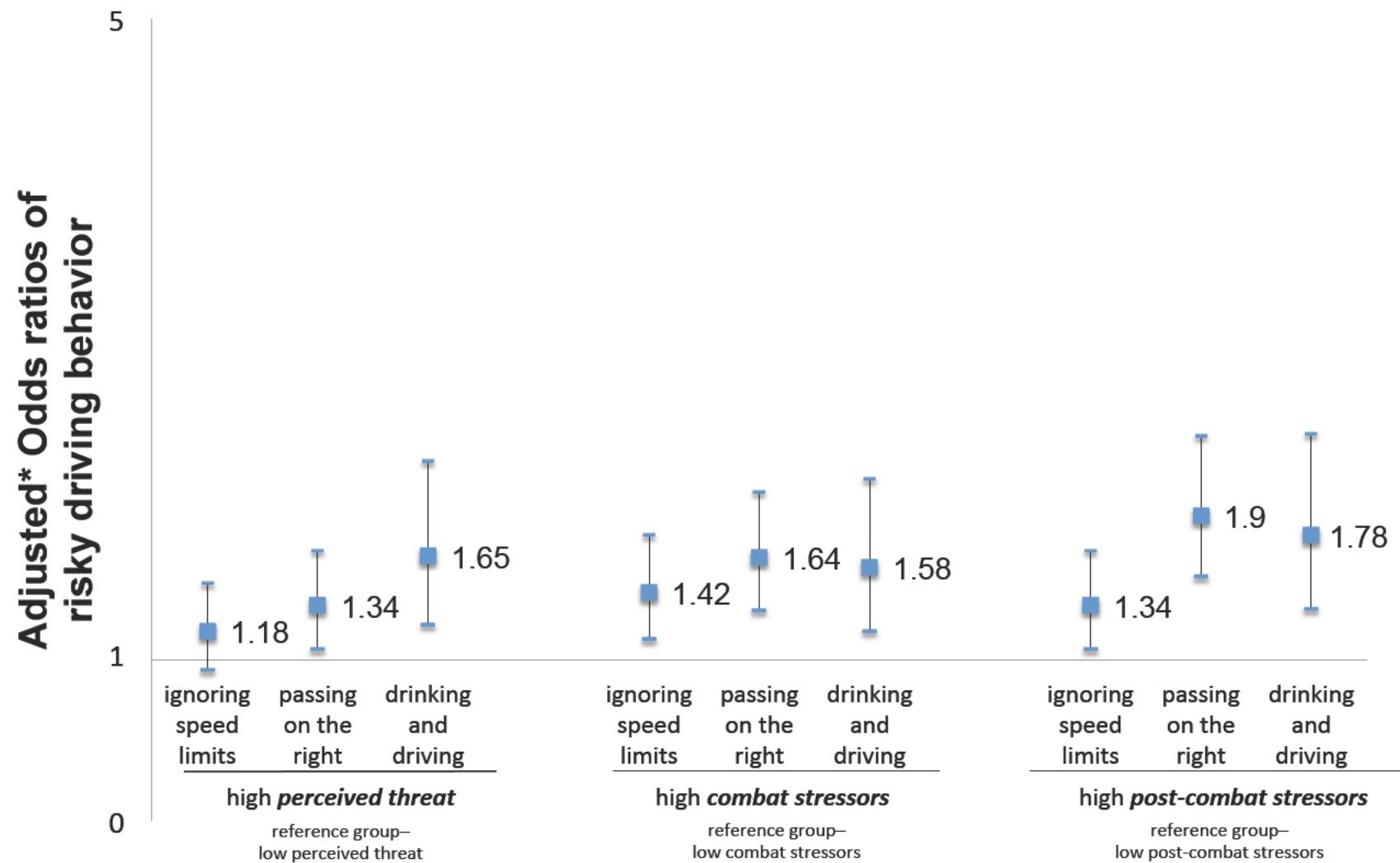
*n=2616; results adjusted for gender, age, race, income, education, marital status and deployment

Psychopathology* was associated with risky driving, adjusting for deployment
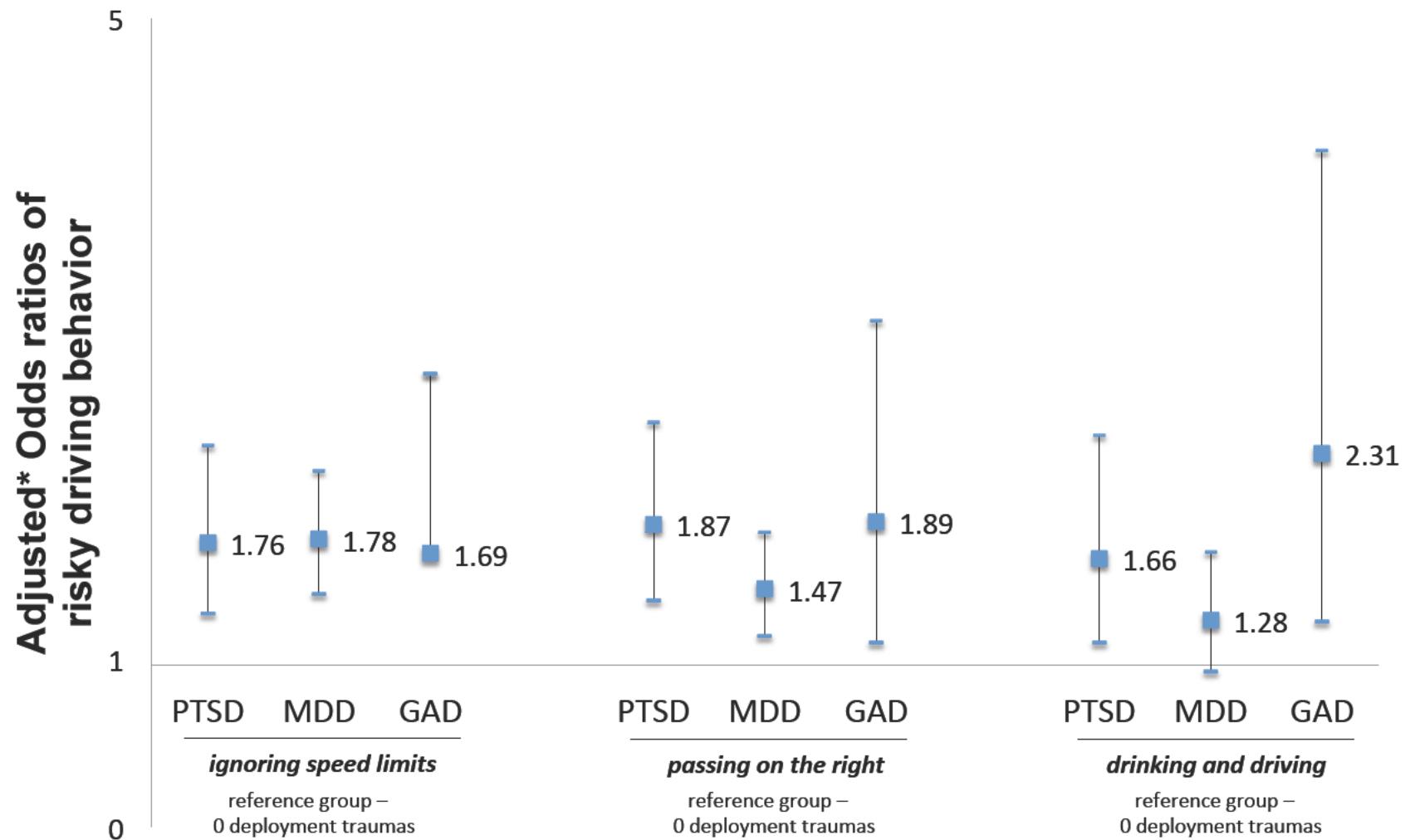
Adjusted* Odds ratios of risky driving behavior

PTSD	MDD	GAD
1.76	1.78	1.69

ignoring speed limits
reference group –
0 deployment traumas

PTSD	MDD	GAD
1.87	1.47	1.89

passing on the right
reference group –
0 deployment traumas

PTSD	MDD	GAD
1.66	1.28	2.31

drinking and driving
reference group –
0 deployment traumas

*n=2616; results adjusted for gender, age, race, income, education, marital status and deployment; mental health disorders include posttraumatic stress disorder (PTSD), major depressive disorder (MDD), and generalized anxiety disorder (GAD)

Pre-deployment preparedness and post-deployment support were associated with *lower* odds of risky driving
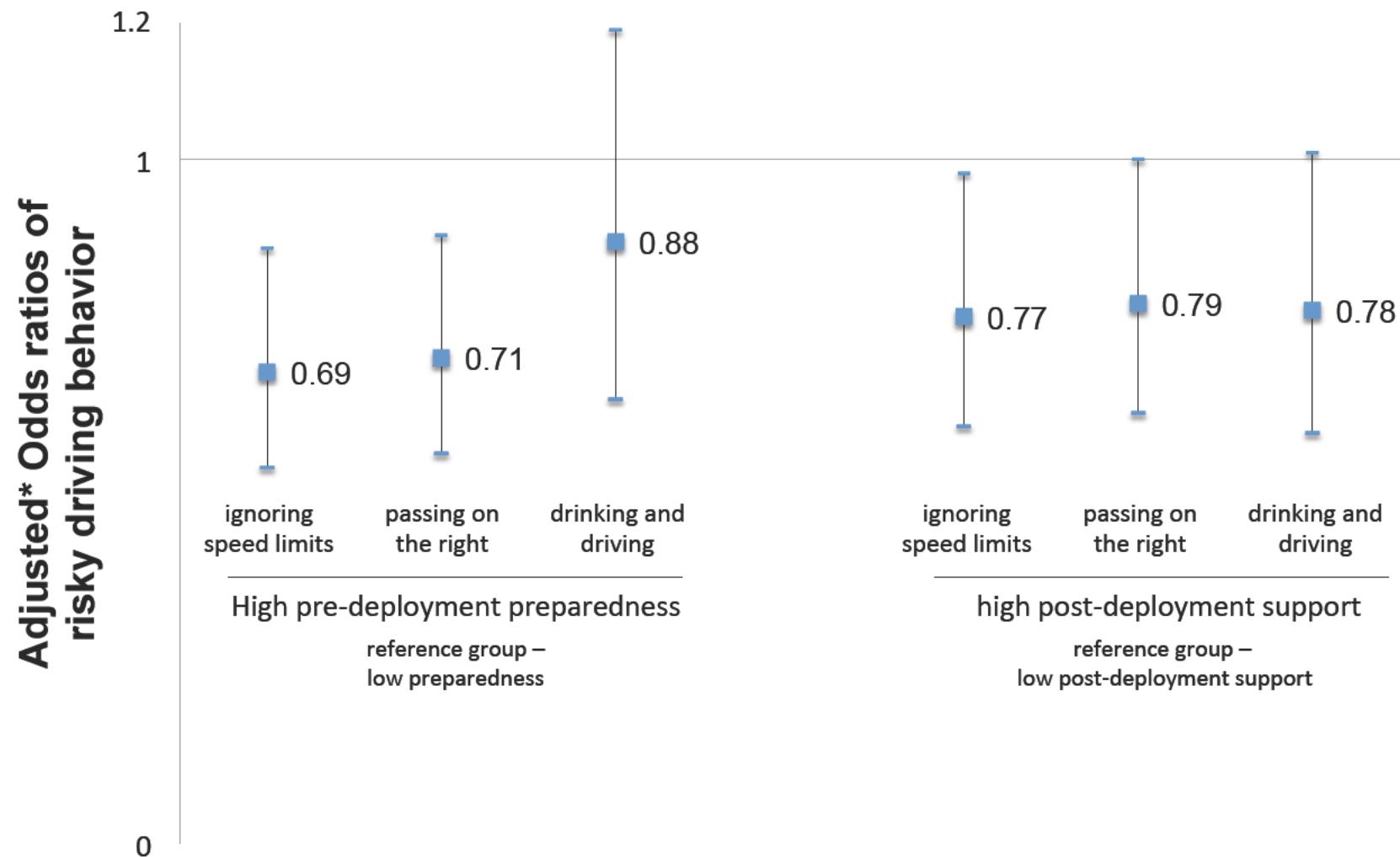
*n=2616; results adjusted for gender, age, race, income, education, marital status and deployment

Conclusions

- deployment, particularly to conflict zones, is associated with risky driving behavior

- quantity of deployment trauma is associated with risky driving behavior in a dose-response fashion

- exposure to high levels of combat trauma is associated with risky driving behavior

- pre-deployment preparedness and post-deployment social support were associated with a reduction in odds of risky driving behavior

PTSD and HIV risk behavior

Study aim

To determine whether PTSD and depression were associated with increased engagement in HIV risk behavior, and examine the direct and indirect effects of PTSD on HIV risk behavior.

Which HIV risk behaviors did we examine?

- intravenous drug use (past year)

- treatment for a sexually transmitted or venereal disease (past year)

- giving or receiving money or drugs for sex (past year)

- anal sex without a condom (past year)

(BRFSS, 2008)

Why examine the relationship between PTSD and HIV risk behavior in soldiers?

- PTSD is associated with a variety of health behaviors that increase risk of morbidity and mortality (Breslau, Davis and Schulz, 2003, Schnurr & Spiro, 1999)

- growing body of literature documenting an association between PTSD and HIV-risk behavior (Brief et al., 2004)

- some have argued that drug-related HIV risk behavior is the result of efforts to self-medicate (Chilcoat & Breslau, 1998)

- HIV risk behaviors are particularly common among those with co-occurring PTSD and depression

Past year HIV risk behavior was associated with gender, age, marital status, race, and income

percent with past year HIV risk behavior
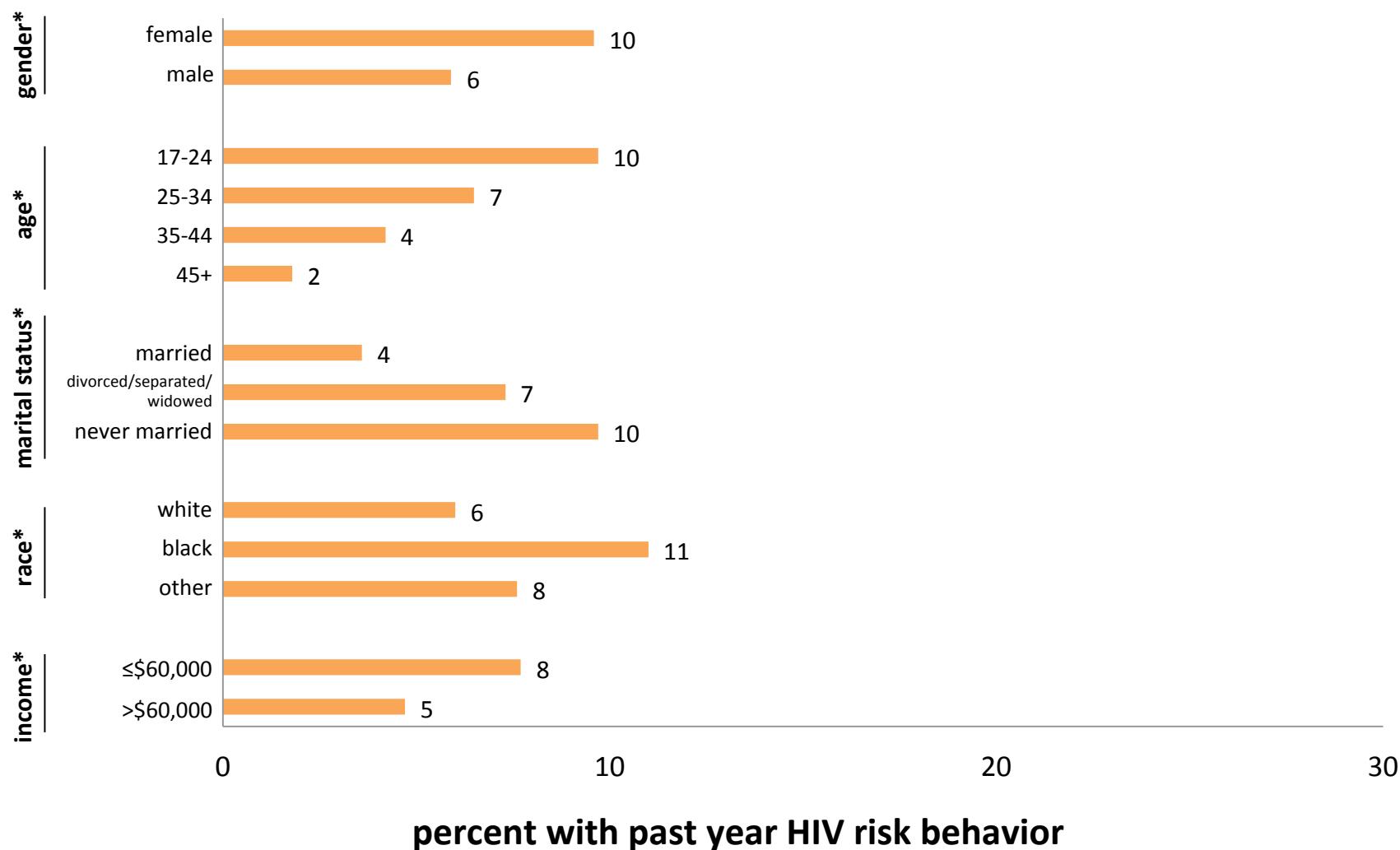
*n=2282; all comparisons significant at p<0.01; div/sep/wid = divorced/separated/widowed

Past year HIV risk behavior was associated with PTSD, depression, and history of alcohol use disorder (AUD)
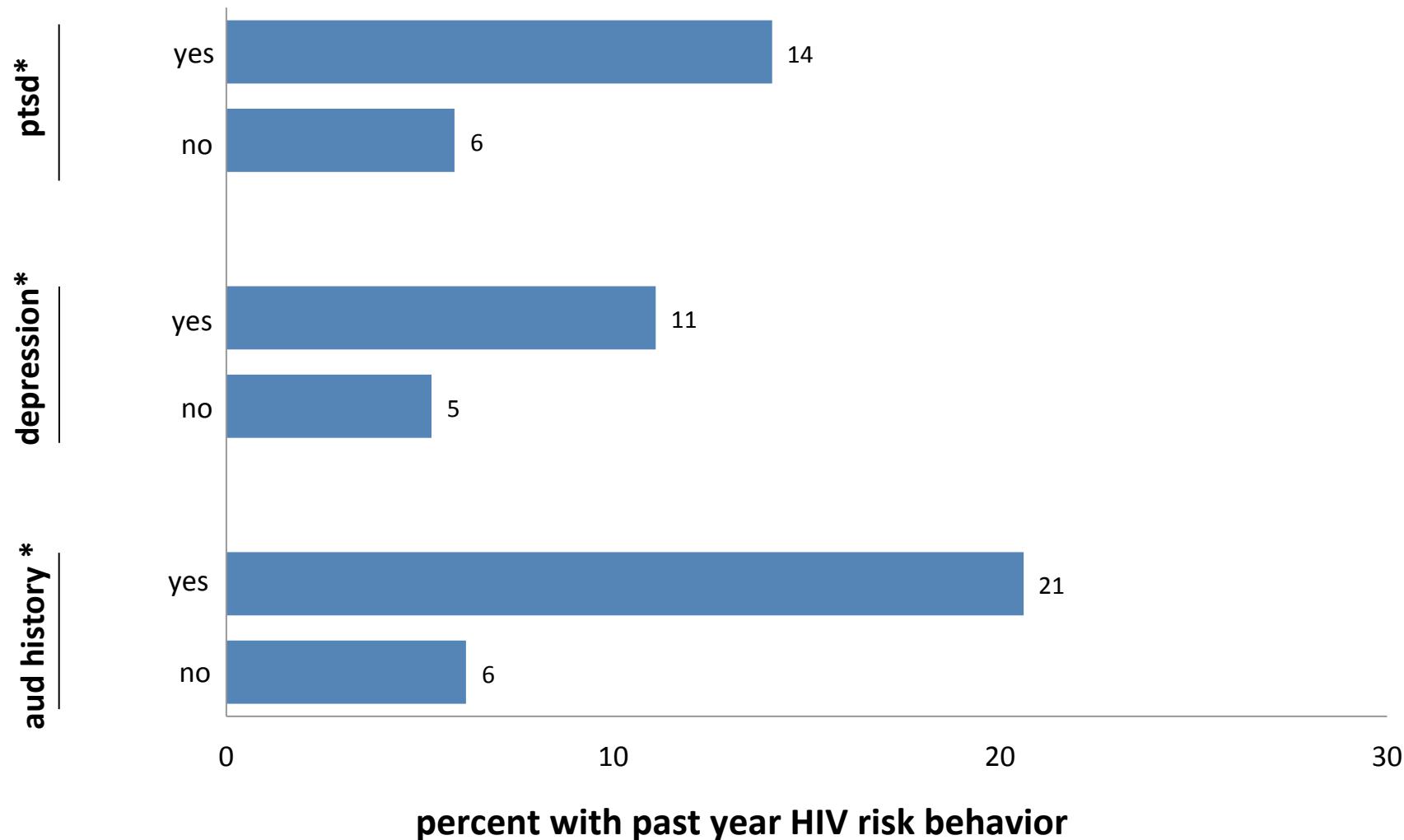
*n=2282; all comparisons significant at p<0.01; aud = alcohol use disorder, including abuse and dependence

Past year HIV risk behavior was not associated with education, insurance status or deployment history
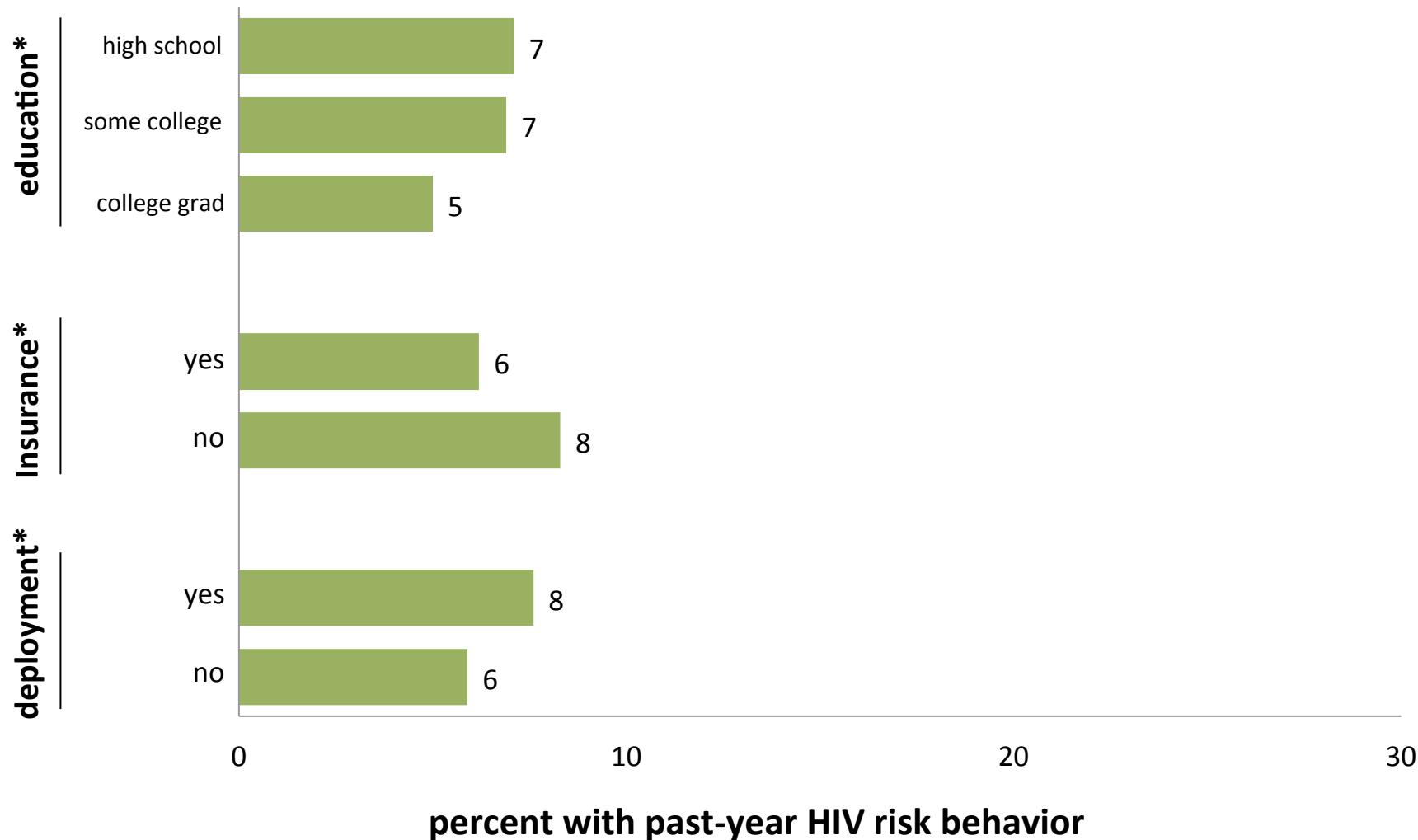
*n=2282; all comparisons non-significant

Depression partially mediates the association between PTSD and HIV risk behavior
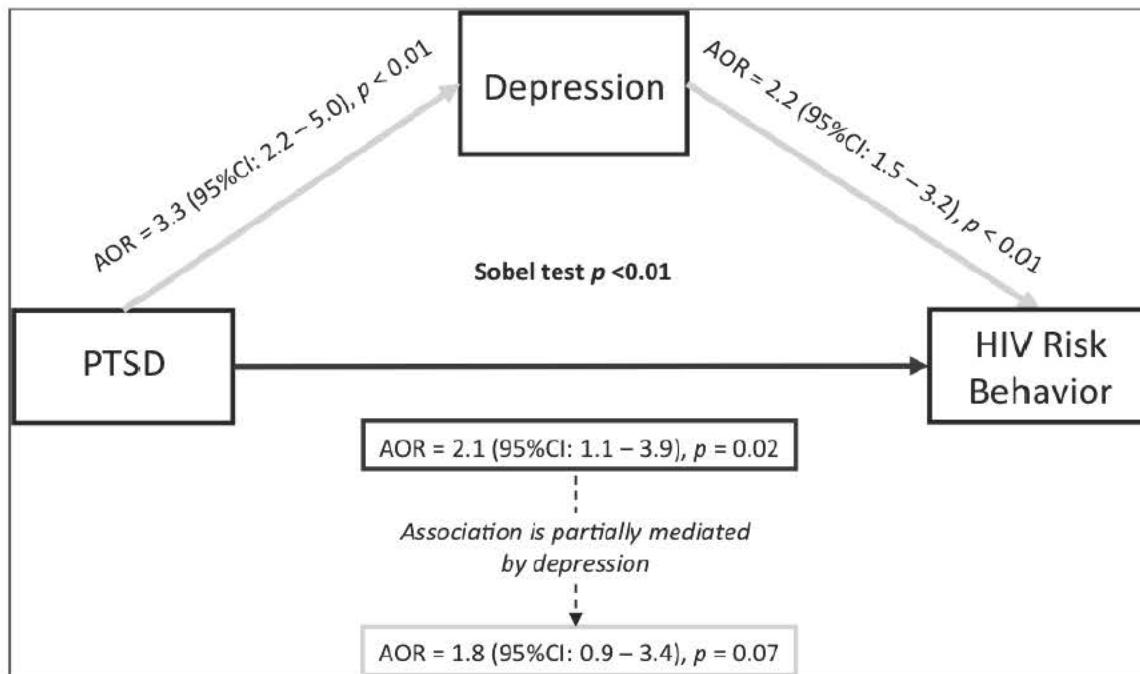
Conclusions

- soldiers with PTSD may be at greater risk of HIV infection due to increased engagement in HIV risk behavior

- new-onset depression following trauma mediates this relationship

- integrated interventions to address mental health problems and reduce HIV risk behavior are needed

Sexual trauma and psychiatric comorbidity

Study aim

To establish prevalence estimates for lifetime sexual trauma exposure among ONG soldiers and examine the prevalence of PTSD, MDD, and comorbid PTSD and MDD among soldiers reporting lifetime sexual trauma

Sexual trauma variables

- rape – "In your lifetime, have you ever been raped?"

- sexual assault – "In your lifetime, have you ever experienced another kind of sexual assault or unwanted sexual contact as a result of force, threat of harm, or manipulation?

- any sexual trauma **–** either rape or sexual assault

Gender distribution of lifetime sexual assault
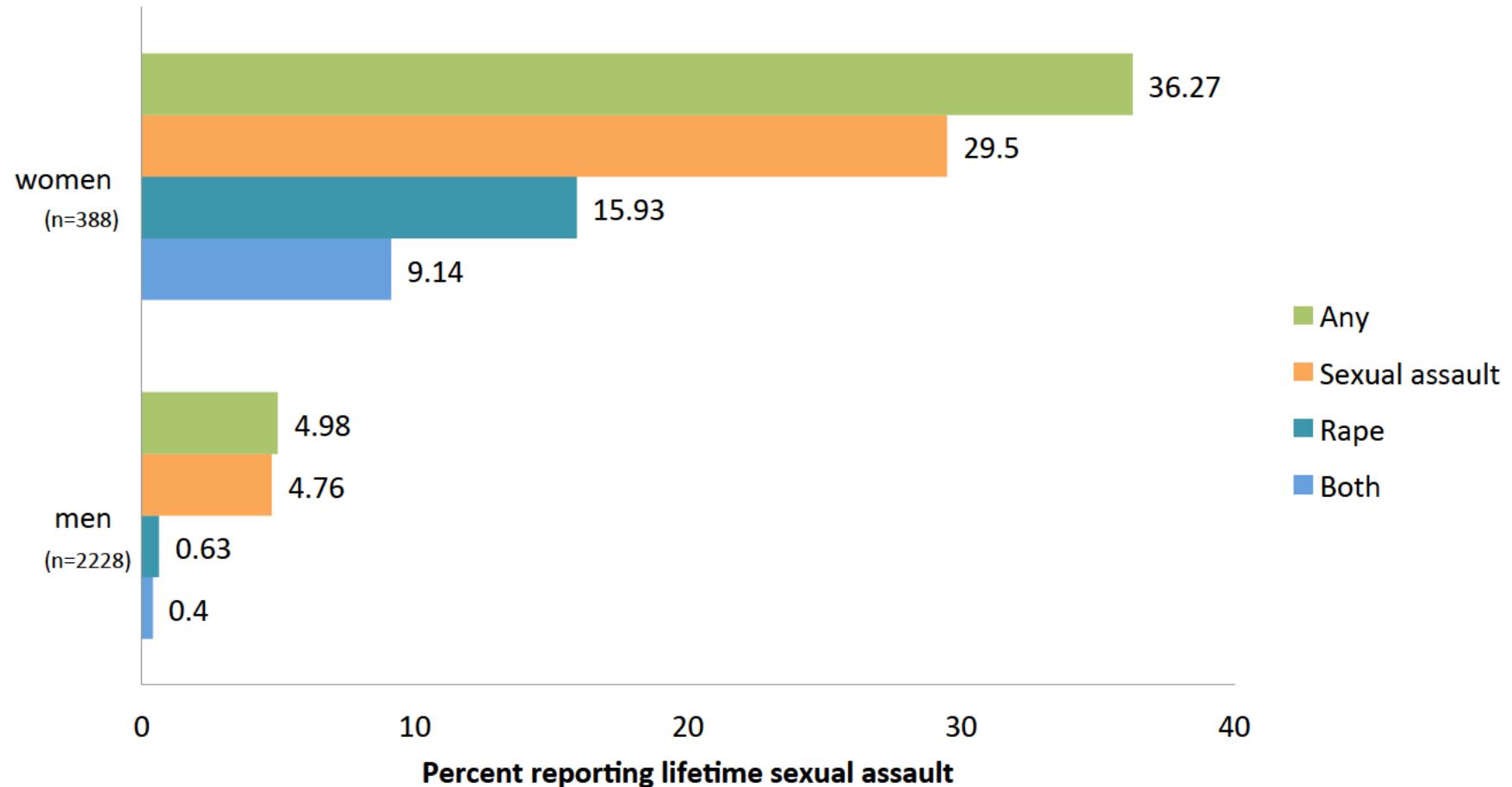
n=2616

Of sexual traumas reported, only a small percent occurred during most recent deployment

sexual assault

6%

(n=114)

4%

(n=106)

rape

5%

(n=61)

7%

(n=14)

women

(n=388)

men
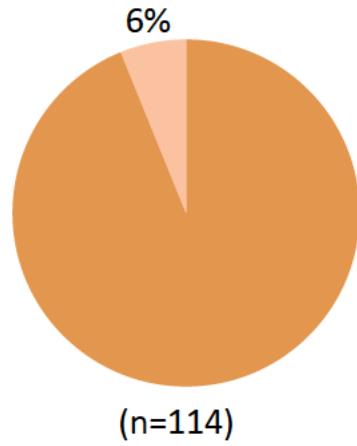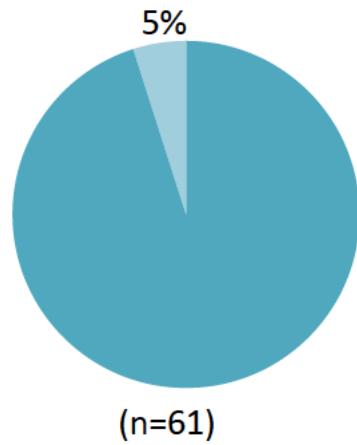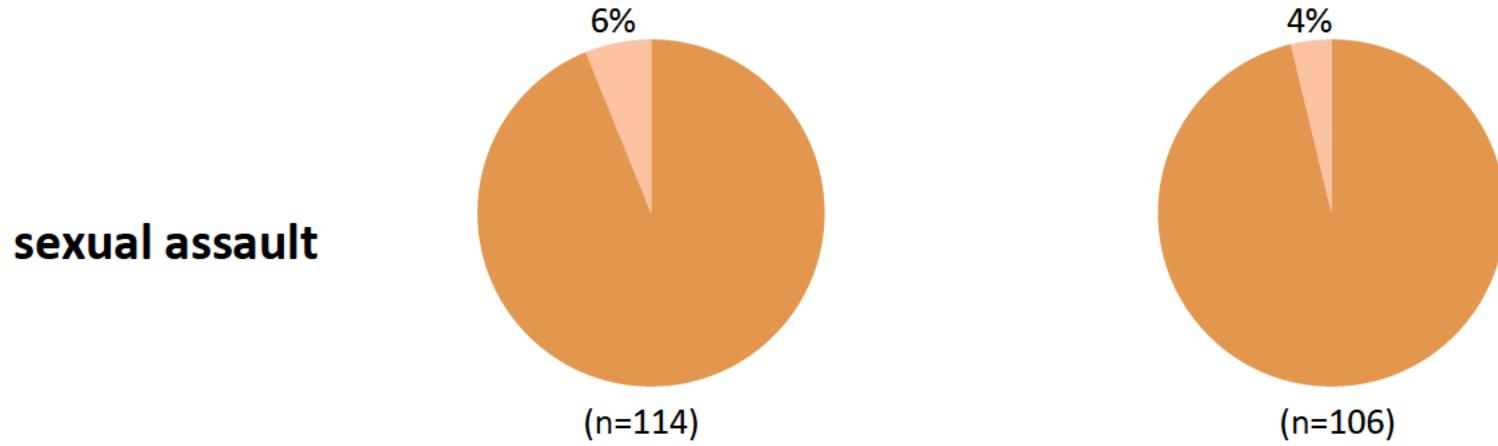
(n=2228)

n=2616

Past year PTSD, depression and both by sexual trauma exposure
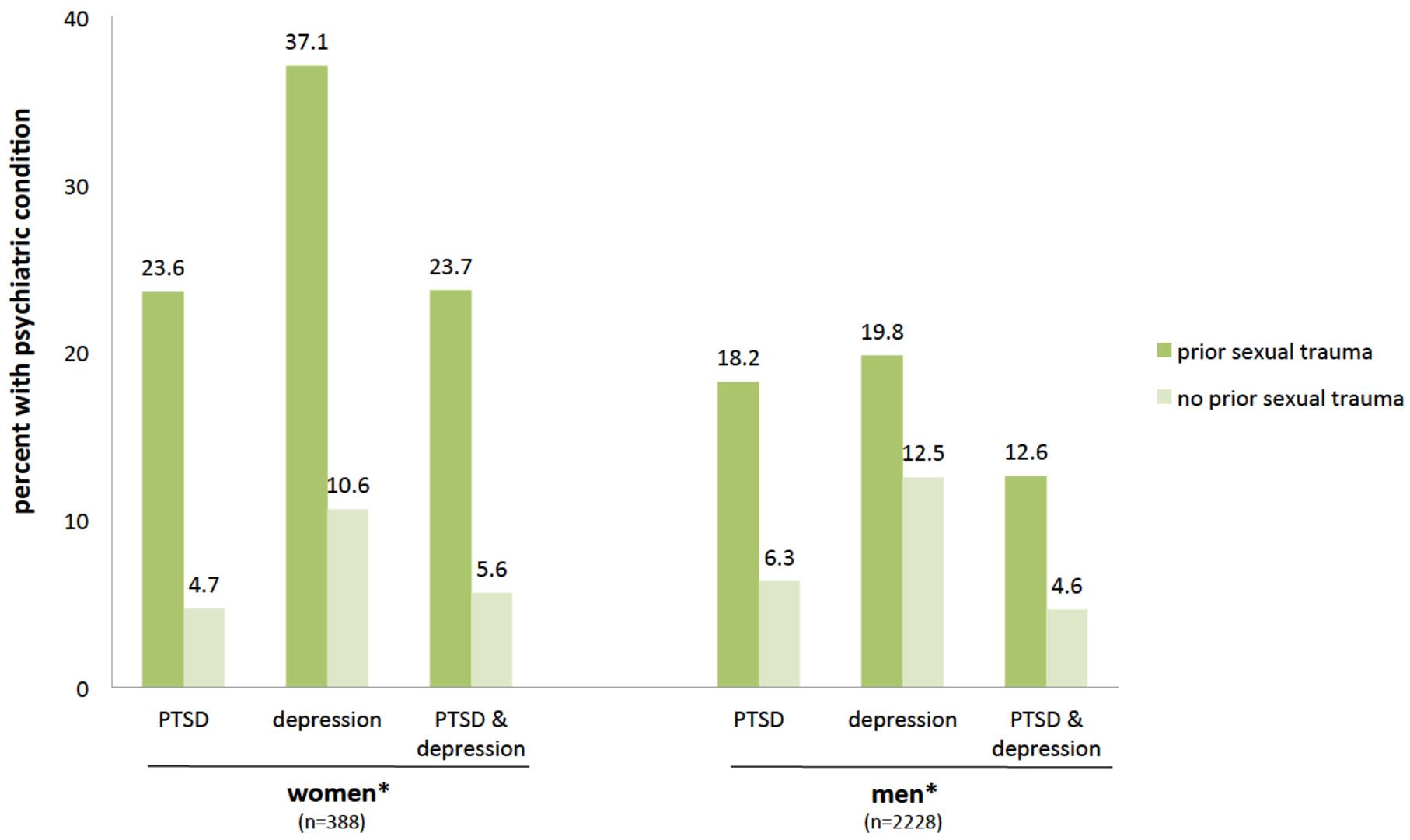
Lifetime PTSD and depression by sexual trauma exposure
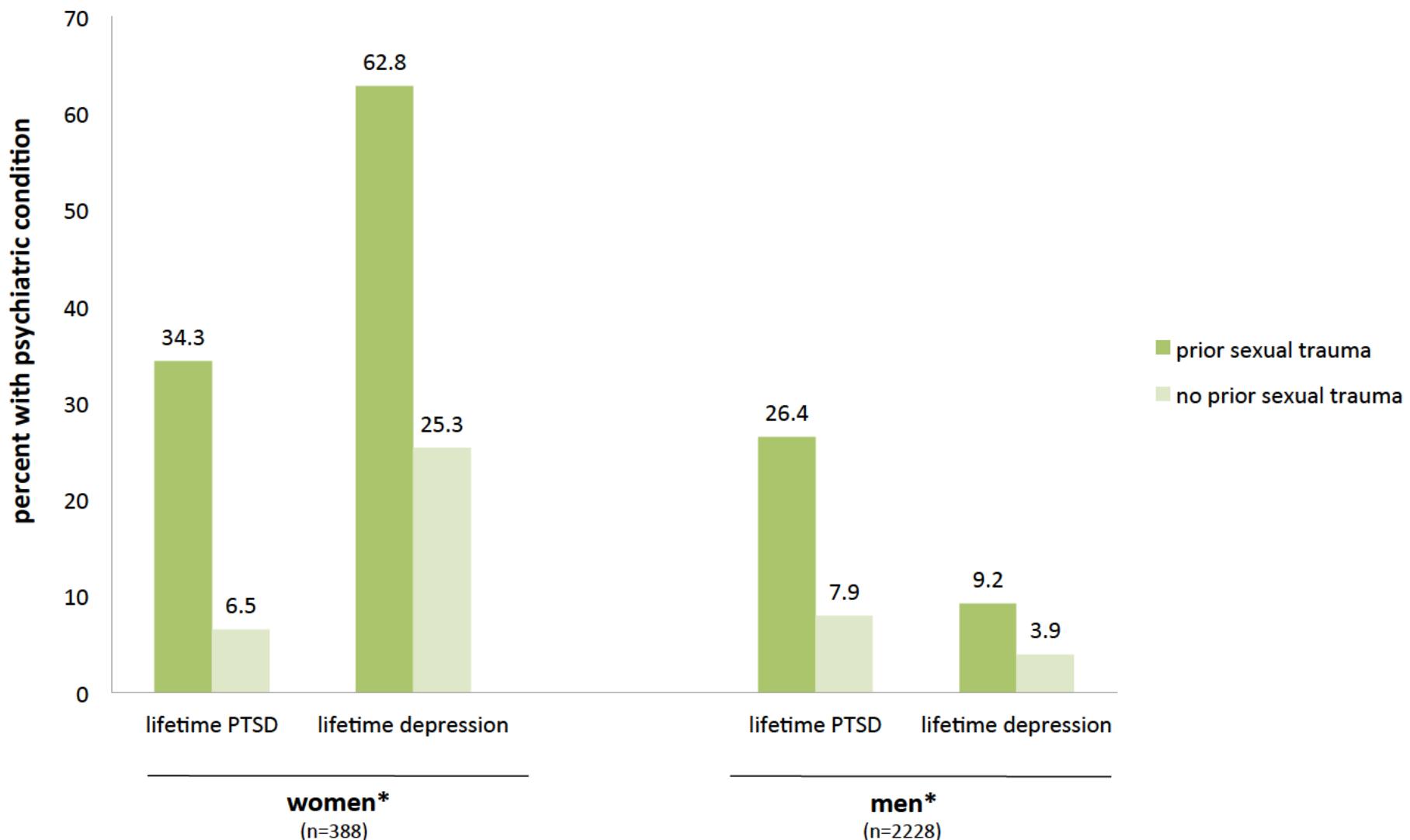
n=2616; *all comparisons significant at p<0.001

Conclusions

- most reported sexual trauma did not occur in the context of deployment

- presence of any sexual trauma was strongly associated with PTSD and depression

- presence of sexual trauma is an important risk factor for PTSD and depression among National Guard soldiers

Differences between war- and civilian-related PTSD

Heterogeneity of PTSD

- Etiologic
- Clinical

Diagnostic differences

- Criterion A2

Co-morbidity differences

- Suicidal ideation

How can we compare PTSD symptoms after different traumatic events?

Heterogeneity of PTSD

- Etiologic
- Clinical

Etiologic heterogeneity

Event A   Event B
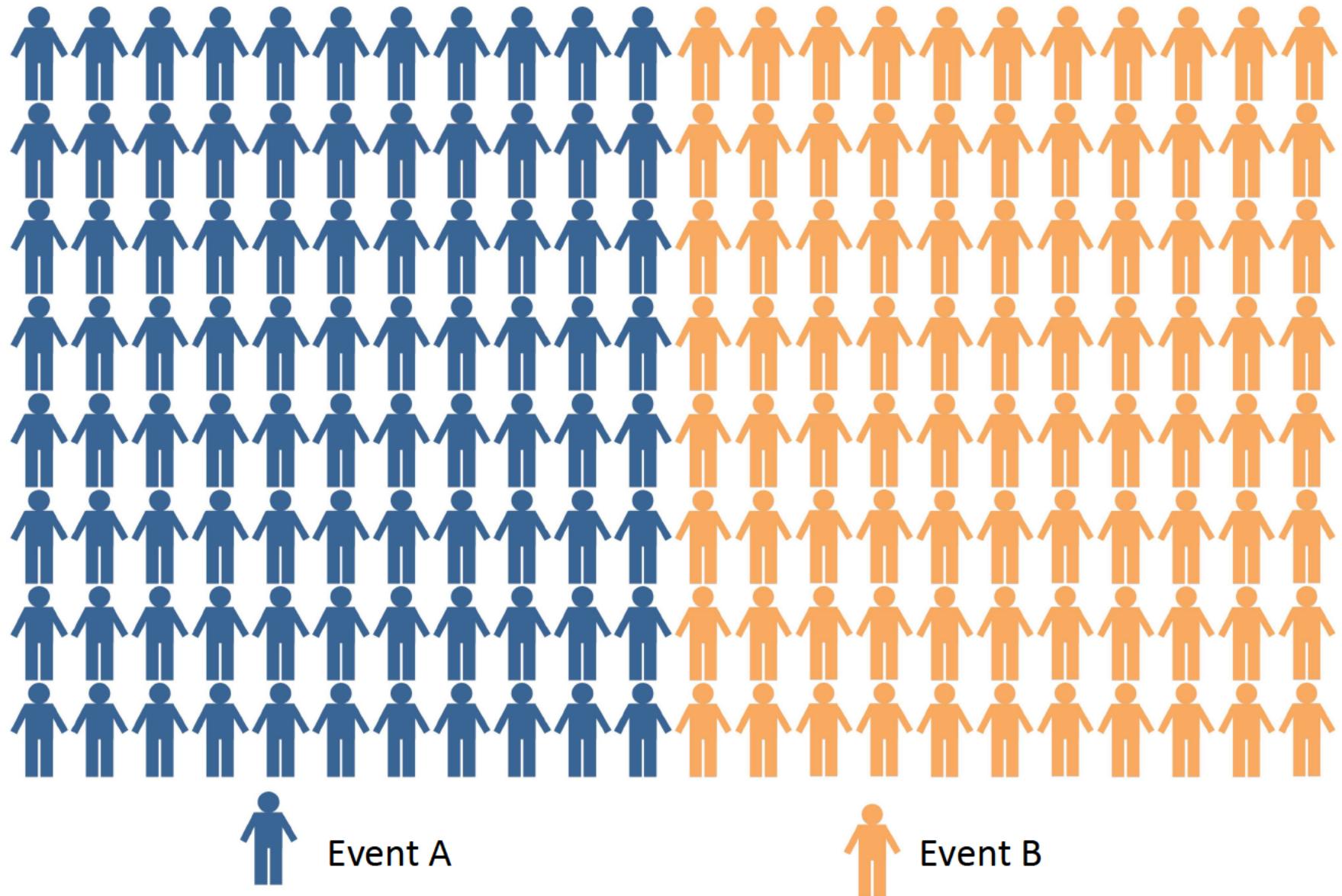
Clinical heterogeneity
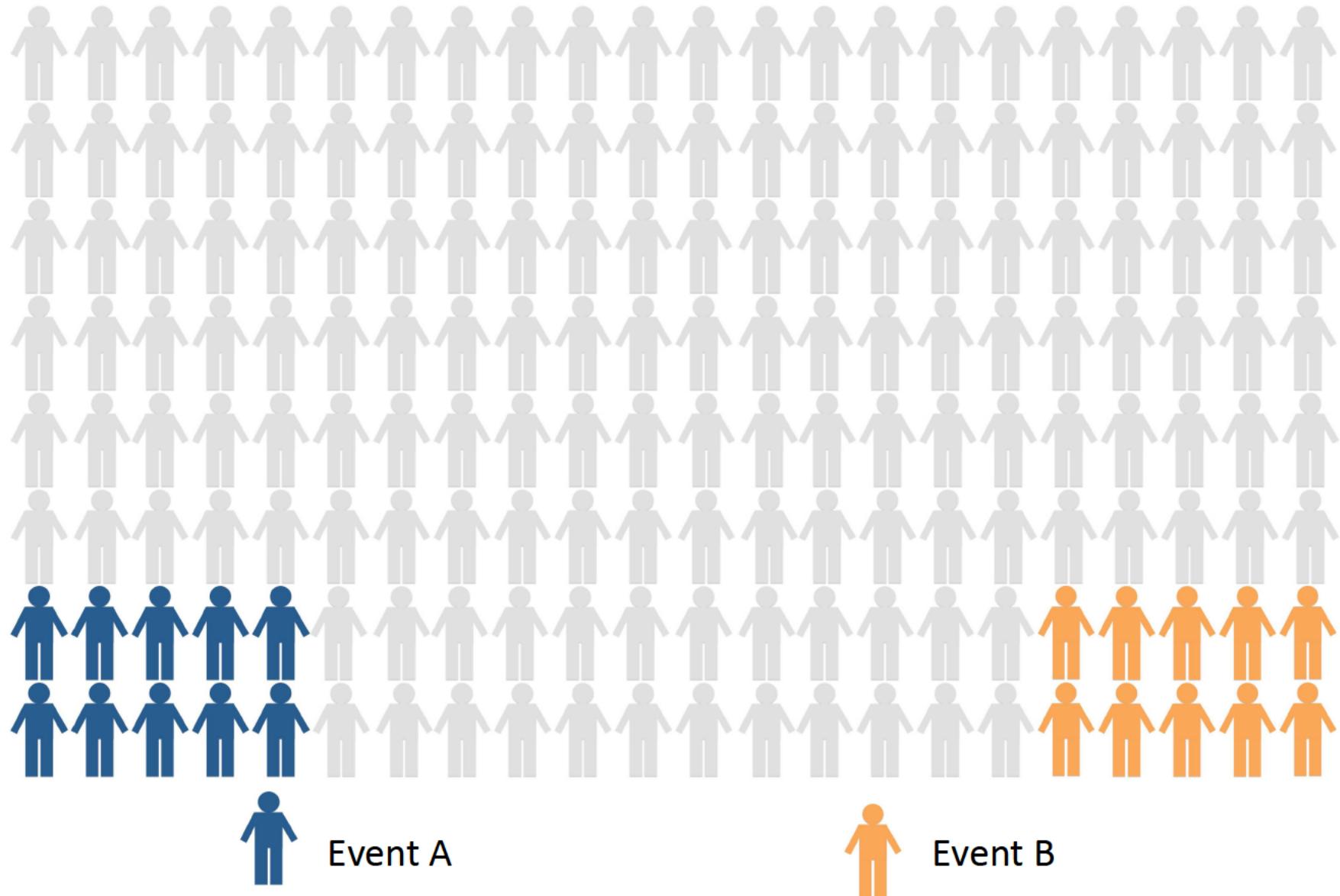
Event A

Event B

Could differences in traumatic event experiences affect the way we diagnose PTSD?

Diagnostic differences

- Criterion A2

Criterion A2

- Fear, helplessness, horror

- Added to DSM-IV in the role of gatekeeper

- Not all events are likely to produce "fear, helplessness, and/or horror"

After certain events, do individuals who do not report criterion A2 develop the remaining PTSD symptom criteria (B-F)?

Breslau et al. 1998, Kessler et al. 1995, Weathers et al. 2001, Breslau and Kessler et al. 2001, Adler et al. 2008, Creamer et al. 2005

Could differences in traumatic event experiences affect other mental health outcomes?

Co-morbidity differences

- Suicidal ideation

Study sample (N=898)

War-related event group (N= 250)

- Experienced one of 3 categories of potentially traumatic events* from deployment to a combat zone and never experienced these events outside of this deployment

Civilian event group (N= 648)

- Experienced one of 3 categories of potentially traumatic events* and have never been deployed or never deployed to a combat zone

*Potentially traumatic events include assaultive, shocking events, sudden death of loved ones

Heterogeneity of PTSD

- Etiologic
- Clinical

Characteristics among those with war-related and civilian-related events
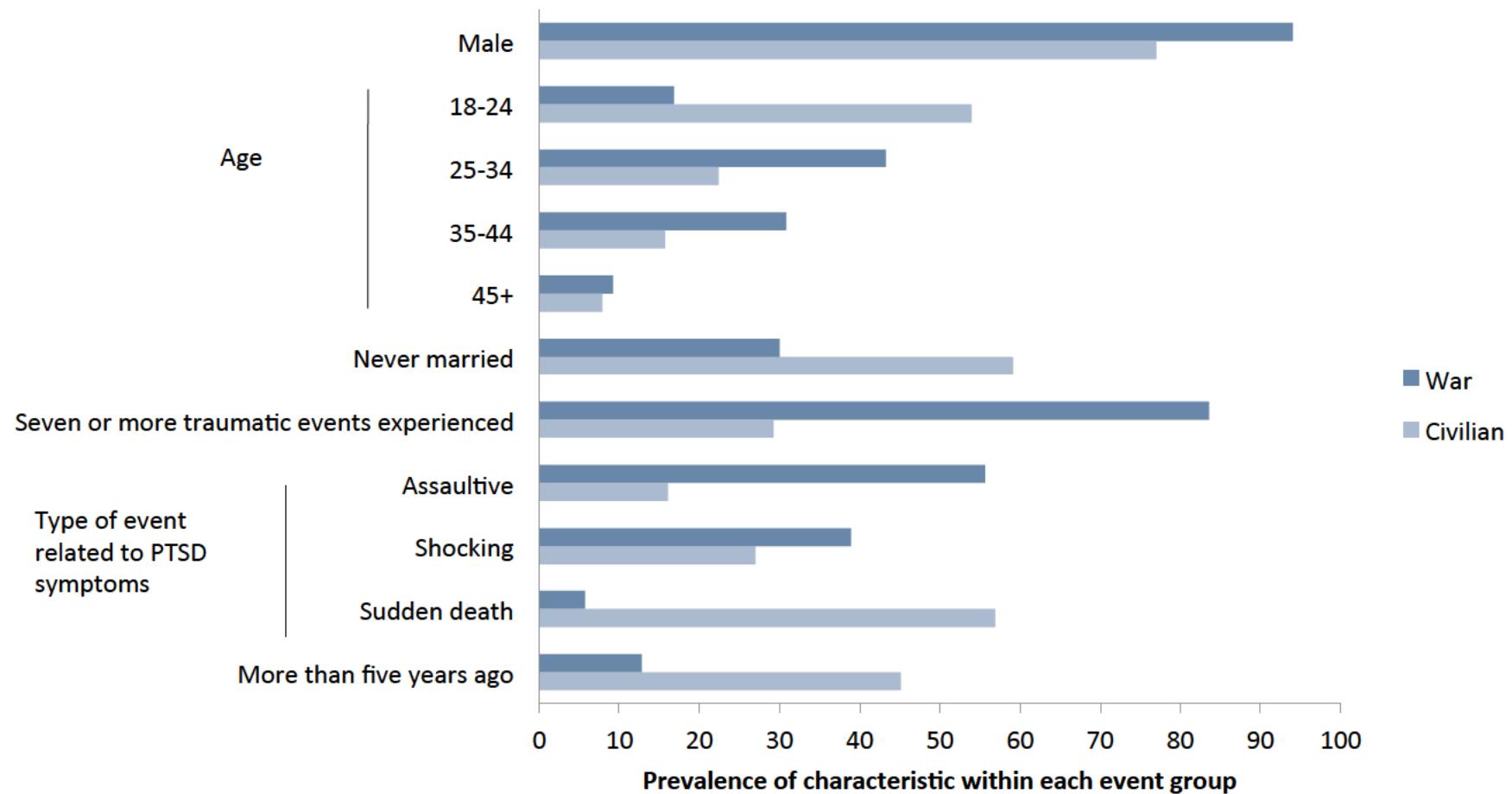
All displayed characteristics were significantly different.

Soldiers with war-events had lower odds of reporting certain symptoms than those with civilian events

Symptoms of PTSD	Adjusted OR* (95%CI)
Criterion A2 Fear, hopelessness or horror	0.46 (0.29 ,0.73)
Criterion B symptoms	0.56 (0.36, 0.87)
Intrusive memories (B1)	0.53 (0.34,0.84)
Nightmares (B2)	0.95 (0.56,1.6)
Flashbacks (B3)	0.78 (0.44,1.39)
Psychological reactivity (B4)	0.62 (0.39,0.98)
Physiological reactivity (B5)	1.38 (0.78,2.43)

*Adjusted for gender, age, marital status, total number of events ever experienced, history of depression before the event, history of PTSD before the event, category of event used to assess PTSD, and if the event occurred more than 5 years ago.

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Similar reporting for symptoms of avoidance and numbness

Symptoms of PTSD	Adjusted OR (95%CI)
Criterion C	0.78 (0.45, 1.34)
Avoid thinking about event (C1)	0.70 (0.44,1.12)
Avoid activities (C2)	0.64 (0.38,1.09)
Trouble remembering (C3)	0.72 (0.35,1.45)
Diminished interest (C4)	0.89 (0.47,1.69)
Detached from people (C5)	0.79 (0.45,1.38)
Feeling emotionally numb/restricted affect (C6)	0.79 (0.43,1.45)
Foreshortened future (C7)	0.88 (0.45,1.73)

*Adjusted for gender, age, marital status, total number of events ever experienced, history of depression before the event, history of PTSD before the event, category of event used to assess PTSD, and if the event occurred more than 5 years ago.

Similar reporting of symptoms of hyperarousal, duration, impairment and PTSD

Symptoms of PTSD	Adjusted OR (95%CI)
Criterion D	1.62 (0.998, 2.64)
Insomnia (D1)	1.23 (0.73, 2.07)
Irritability (D2)	1.14 (0.67,1.94)
Concentration problems (D3)	1.23 (0.71, 2.14)
Hyper-vigilance (D4)	0.87 (0.55, 1.38)
Exaggerated startle (D5)	1.29 (0.75, 2.21)
Criterion E symptoms for 1 month	1.05 (0.64, 1.73)
Criterion F social or functional impairment	0.83 (0.516, 1.33)
DSM-IV PTSD	1.30 (0.61, 2.80)

*Adjusted for gender, age, marital status, total number of events ever experienced, history of depression before the event, history of PTSD before the event, category of event used to assess PTSD, and if the event occurred more than 5 years ago.

Discussion and conclusion

clinical heterogeneity

- soldiers with war-related events had lower odds of reporting certain symptoms compared to soldiers with civilian events
    - criterion A2
    - criterion B

Diagnostic differences

- Criterion A2

Those with civilian events were more likely to report criterion A2
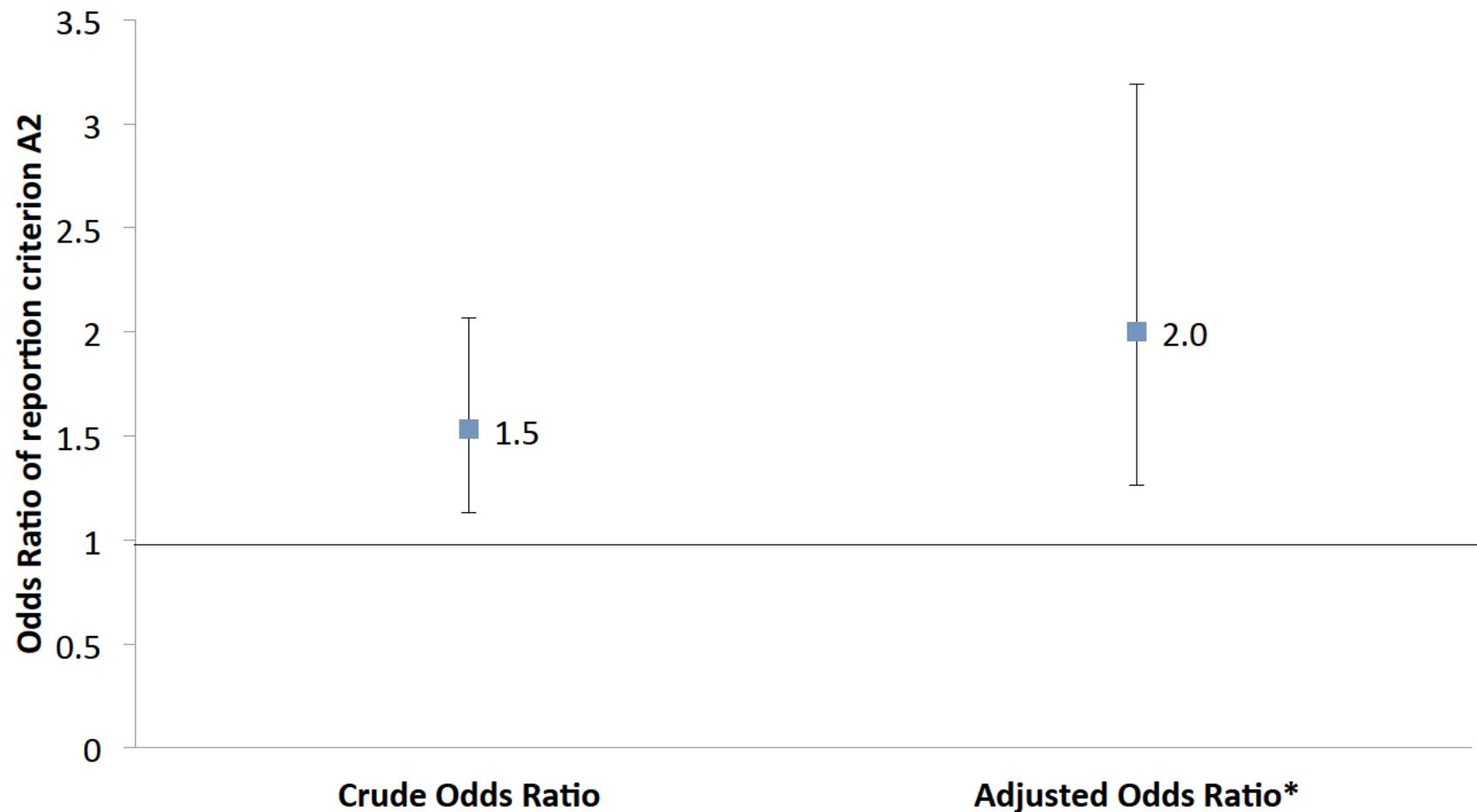
*Model is adjusted for sex, age, marital status, number of events ever experienced, history of PTSD before the event, history of alcohol abuse before the event, the category of index event (assaultive (reference), shocking event, or the sudden death of a loved one), and if the event occurred more than five years ago.

Prevalence of PTSD changes little depending on requirement of A2
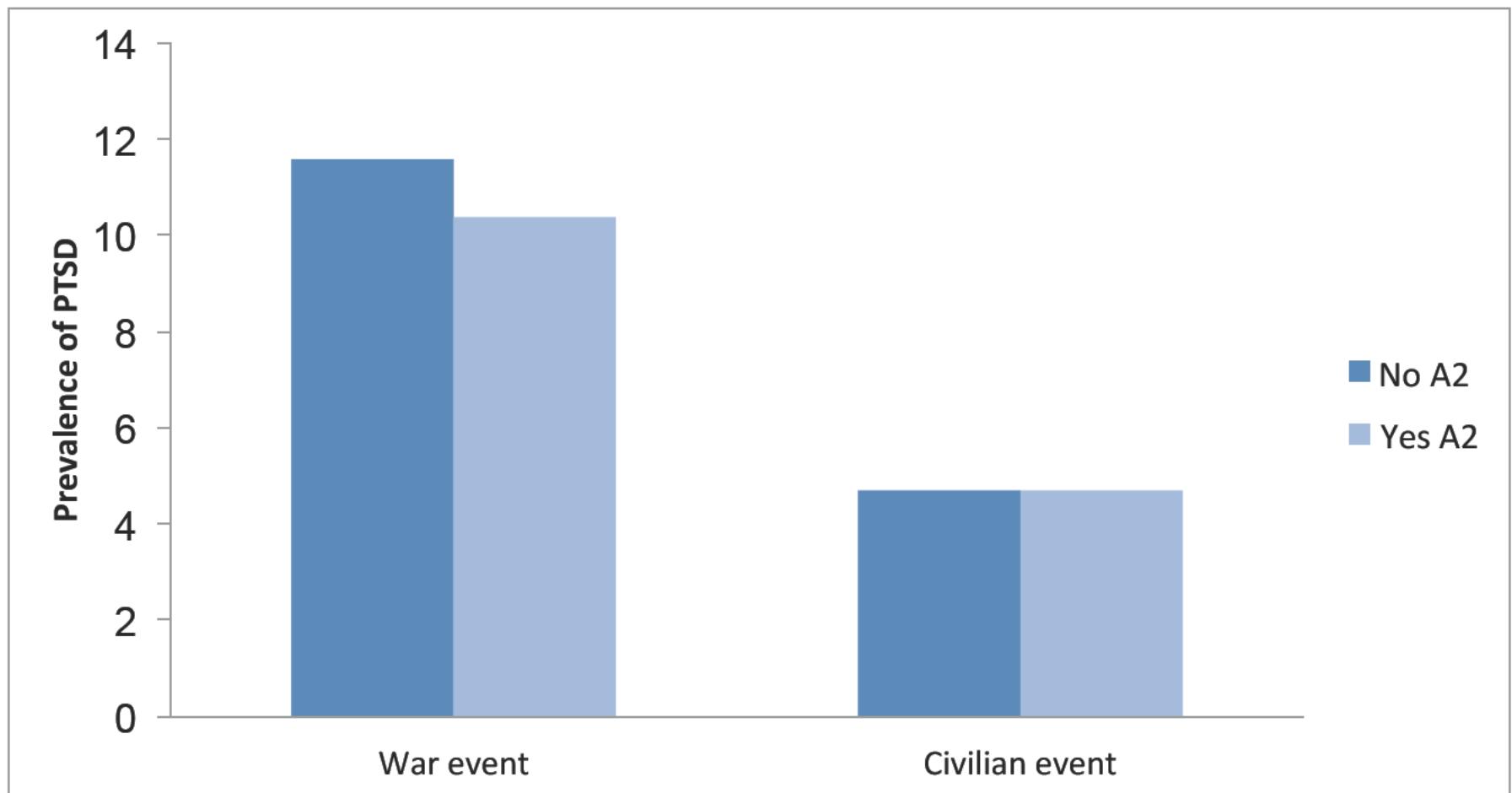
Those who do *not* report criterion A2 are likely to *not* have the remaining PTSD symptom criteria
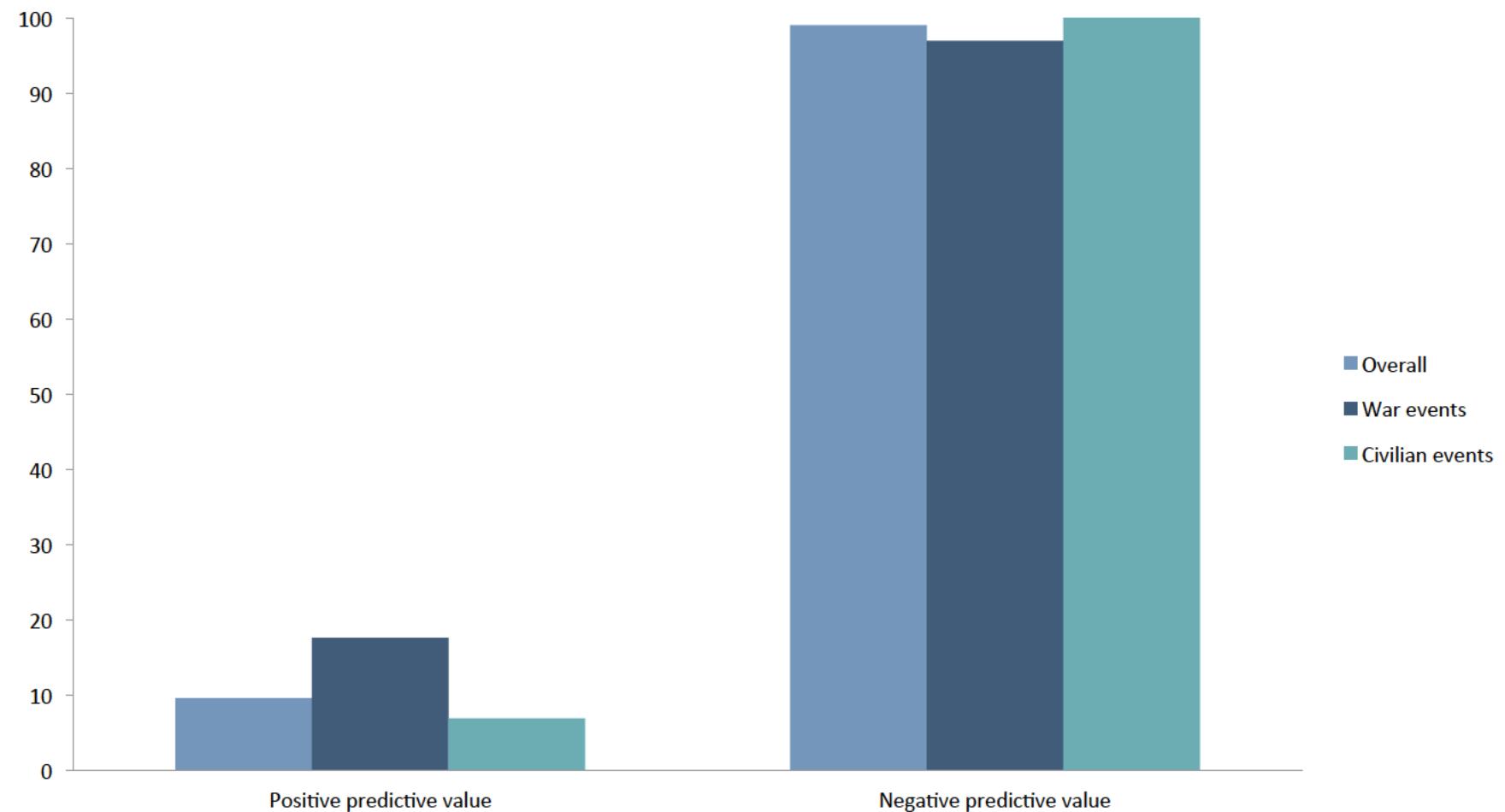
Discussion and conclusion

Reporting of criterion A2 for war-related events

- ▪ Does not affect prevalence of PTSD

- ▪ Low positive predictive value (9%) and high negative predictive value (99%)

Co-morbidity differences

- Suicidal ideation

Any event matters
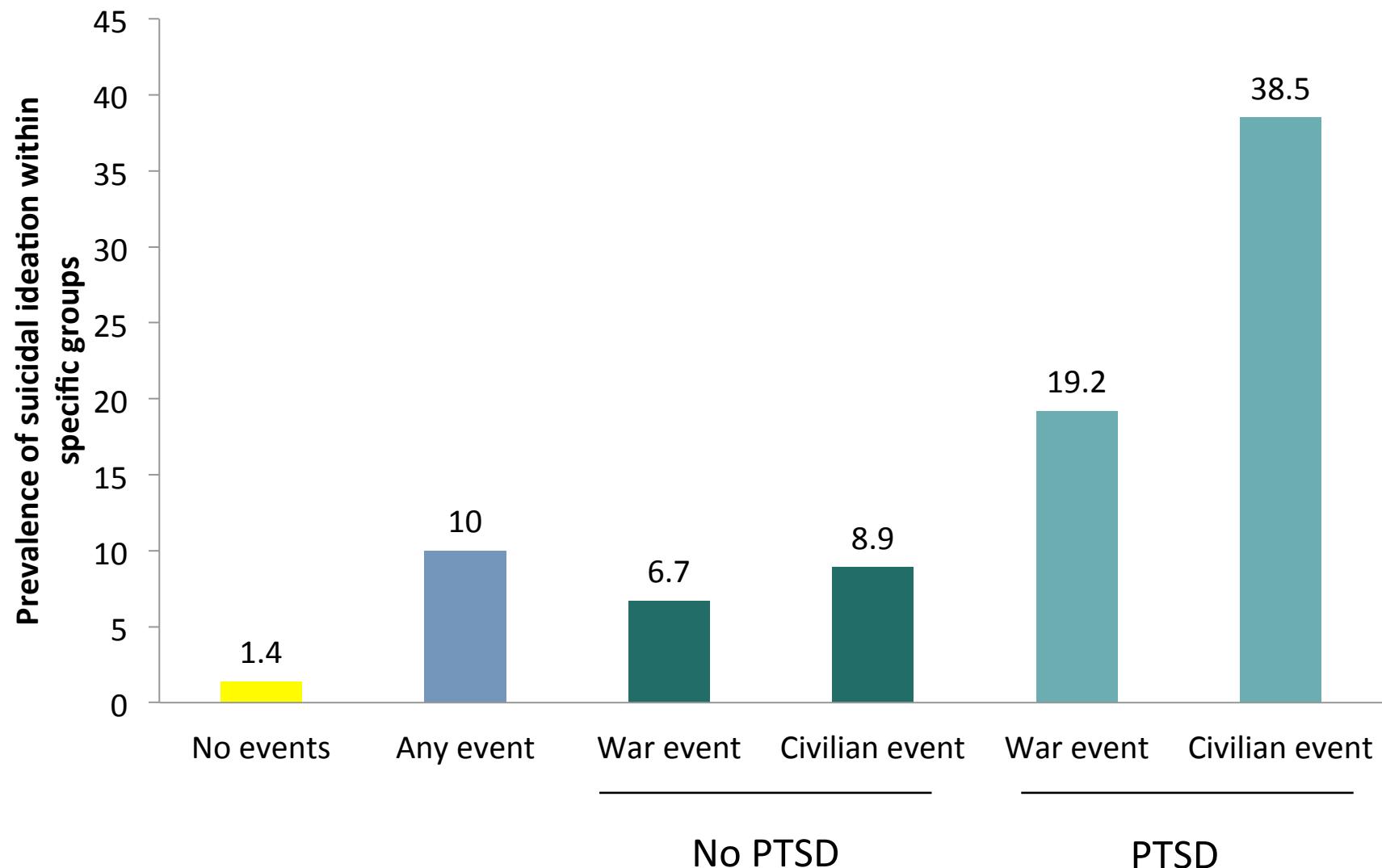
Among those without PTSD, soldiers with civilian events are more likely to report suicidal ideation than those with war events.
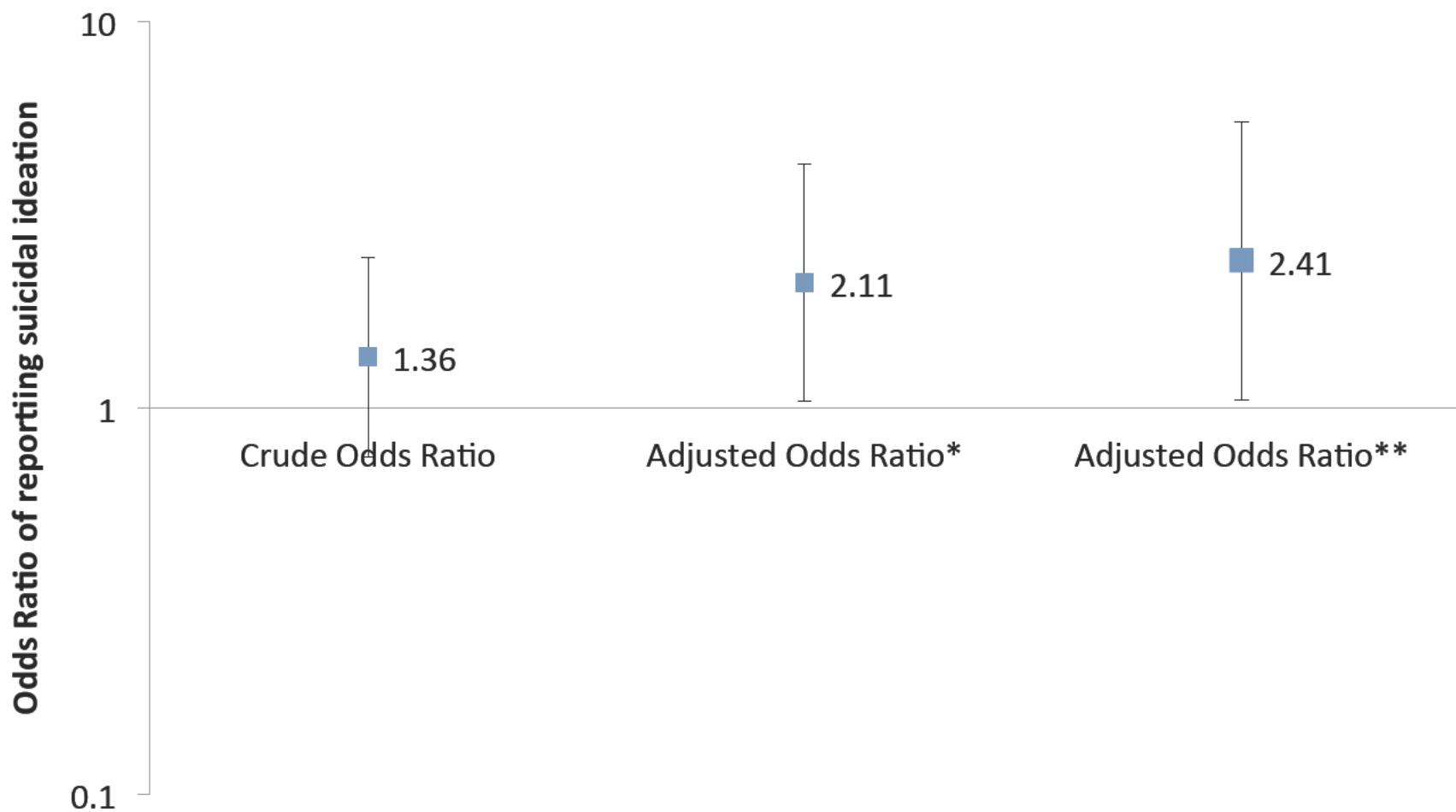
*Model is adjusted for sex, age, number of events ever experienced, history of PTSD before the event, history of alcohol abuse before the event, the category of index event (assaultive (reference), shocking event, or the sudden death of a loved one), and if the event occurred more than five years ago. ** model also adjusted for marital status

Conclusions

- presence of etiologic and clinical heterogeneity

- experience of any event is associated with suicidal ideation compared to those who do not experience an event

- soldiers who experience civilian-related events are more likely to report suicidal ideation than are soldiers with war-related events

  - Healthy warrior effect, more severe events

  - Unit support and preparedness

  - Mental health services

- criterion A2 did not affect the prevalence of PTSD

Addictive behaviors, depression and suicidal ideation in the ONG

Alcohol dependence and
incident suicidal ideation

Study aim

To investigate the longitudinal relationship between alcohol dependence and incident suicidal ideation in a representative sample of Ohio Army National Guard soldiers.

We removed the 10.4% with a lifetime history of suicidal ideation at wave 1 to examine *incidence*
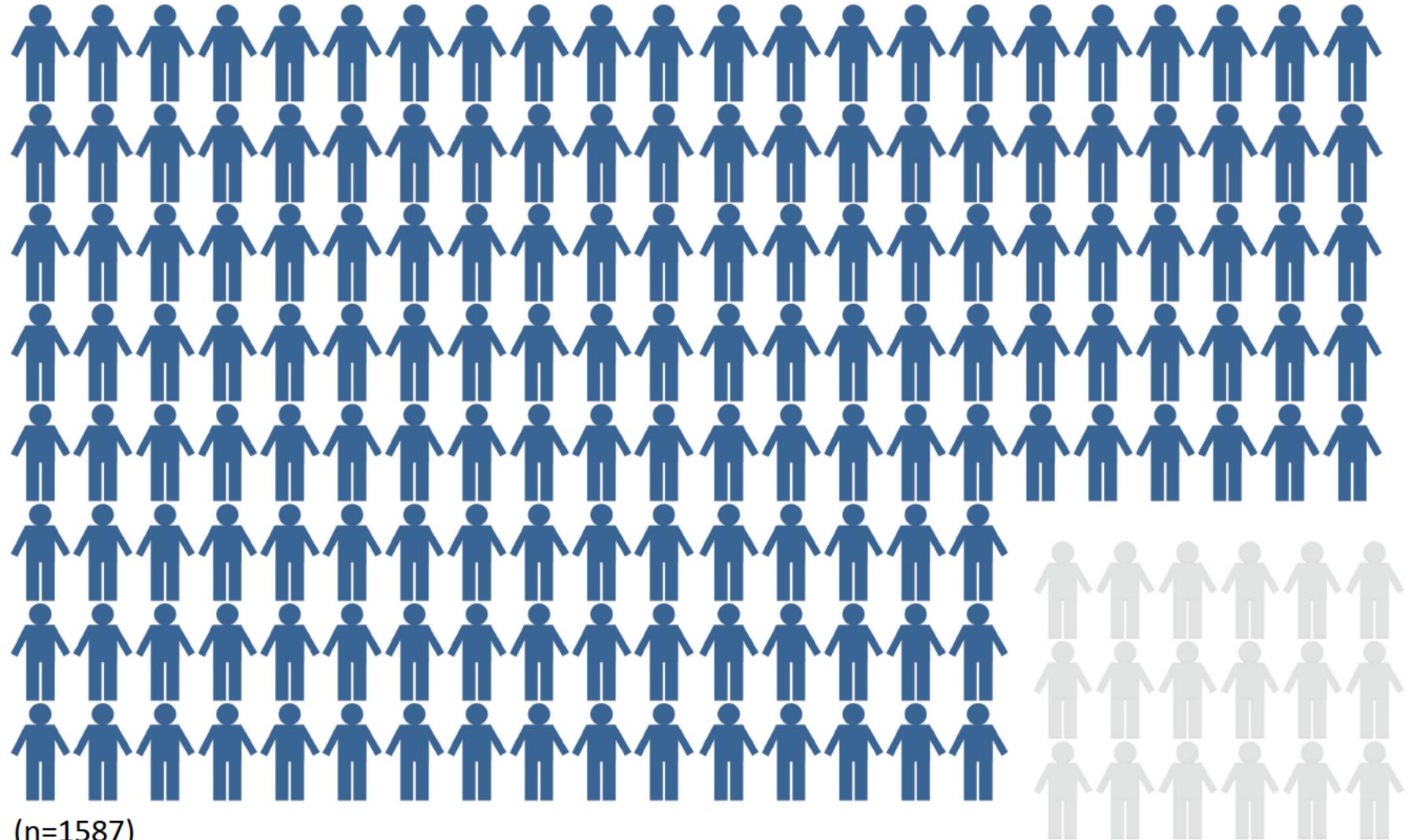
(n=1587)

(Wave 1 lifetime suicidal ideation, phq-9: n=183)

Baseline alcohol dependence is significantly associated with incident suicidal ideation at follow-up

Baseline Alcohol dependence
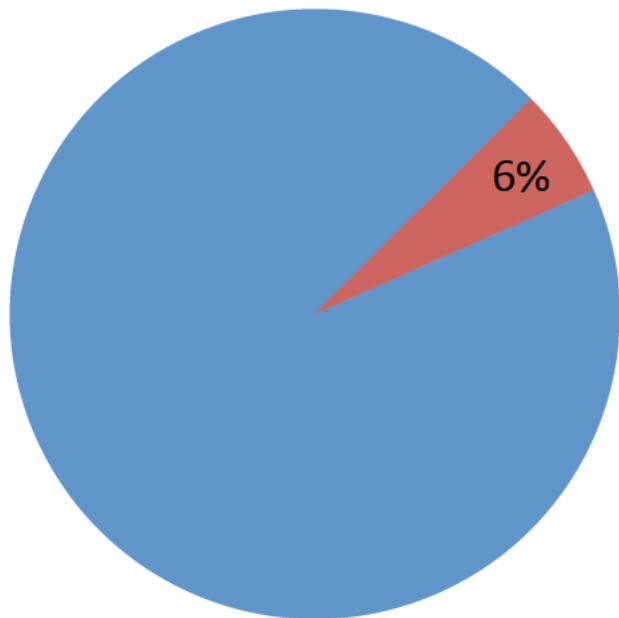
Follow-up incident suicidal ideation

6%

9%

2%

p=0.0002
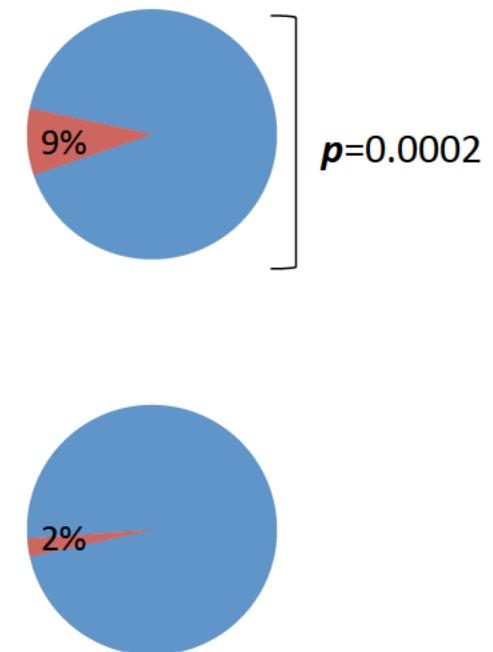
n=1587; percent alcohol dependence and suicidal ideation reported for particpants meeting criteria

Depression within a year of baseline was associated with incident suicidal ideation at follow-up
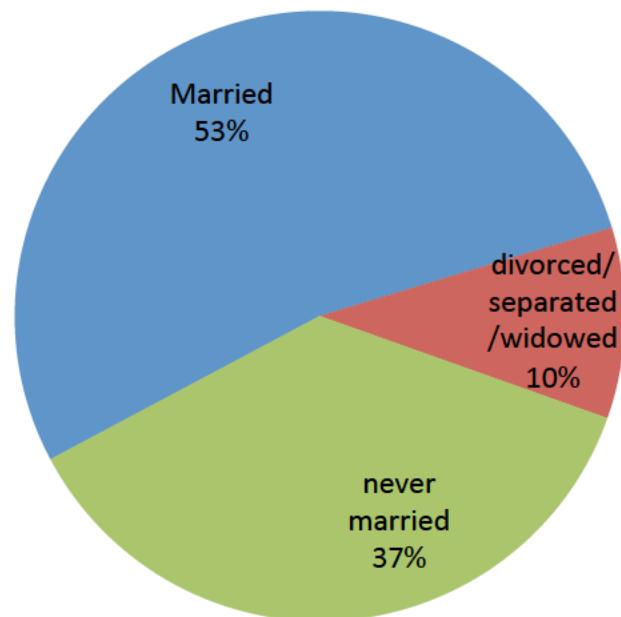
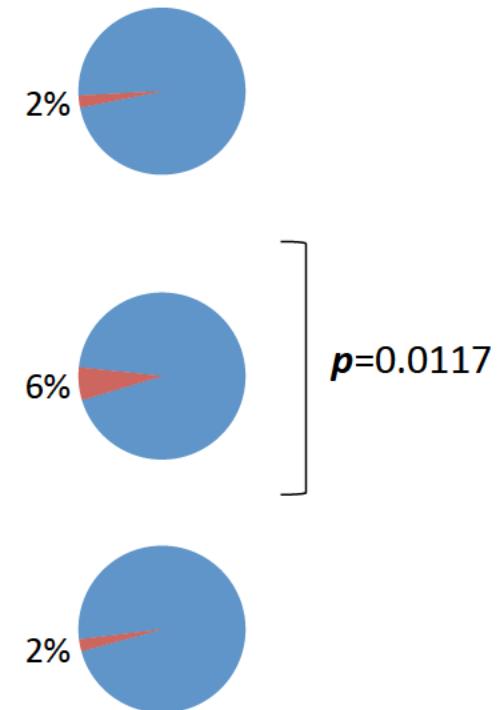**Wave 1** depression

Wave 2 incident suicidal ideation

10%

9%

p<0.0001

2%
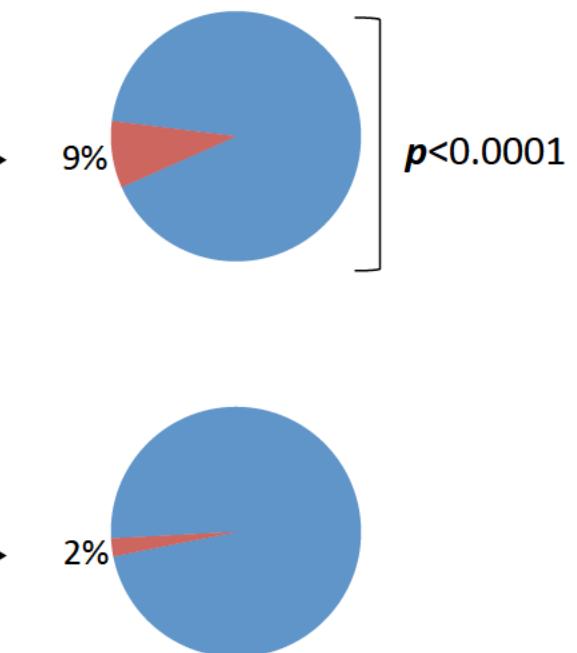
n=1587; percent depression and suicidal ideation reported for participants meeting criteria

At follow-up, those who were married were less likely to report incident suicidal ideation in the past year
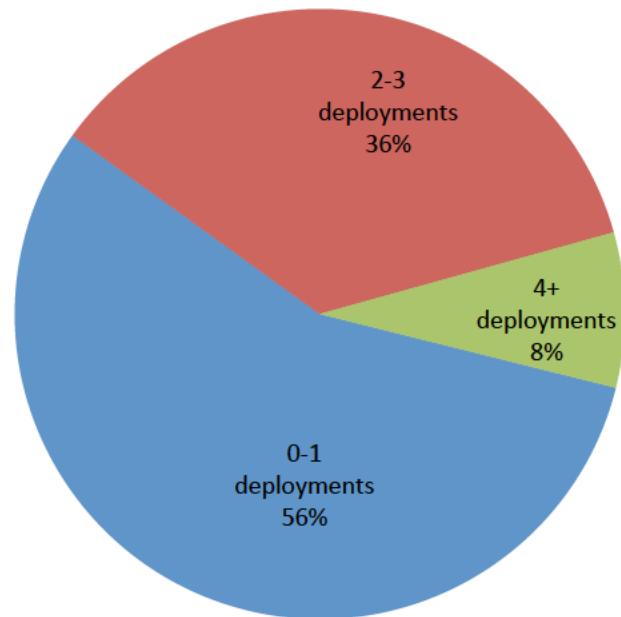
Wave 2 marital status

Wave 2 incident suicidal ideation
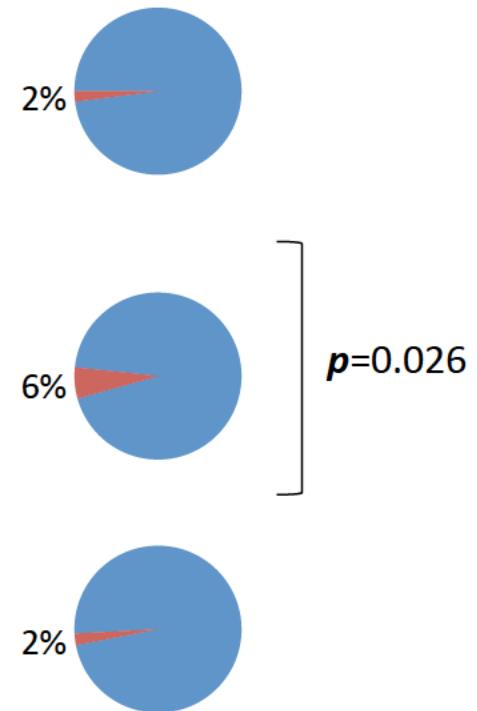

2%

6%

p=0.0117

2%

n=1587; percent suicidal ideation reported for participants meeting criteria

And, number of lifetime deployments at wave 2 were associated with incident suicidal ideation
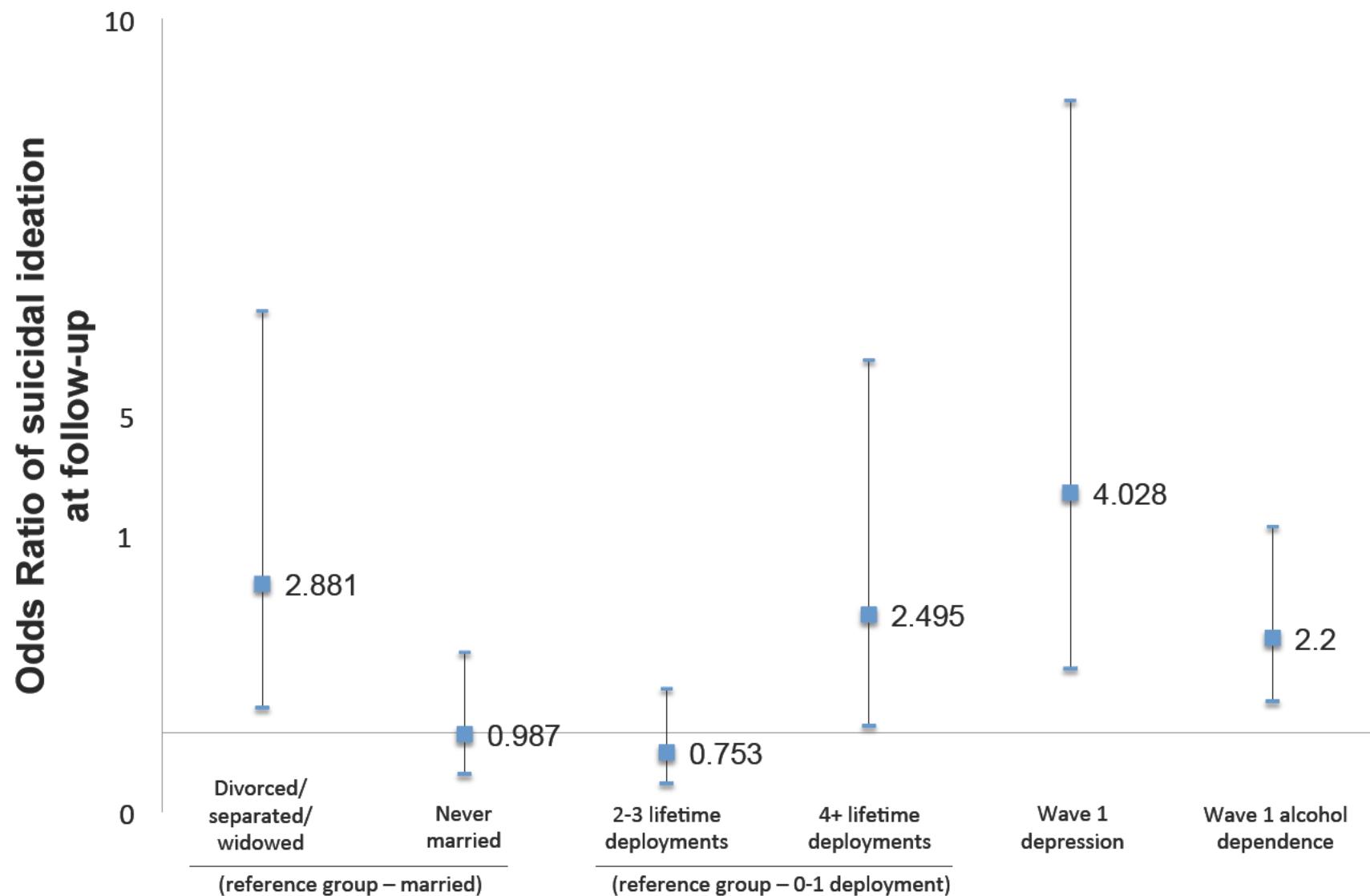
Wave 2 Number of lifetime deployments
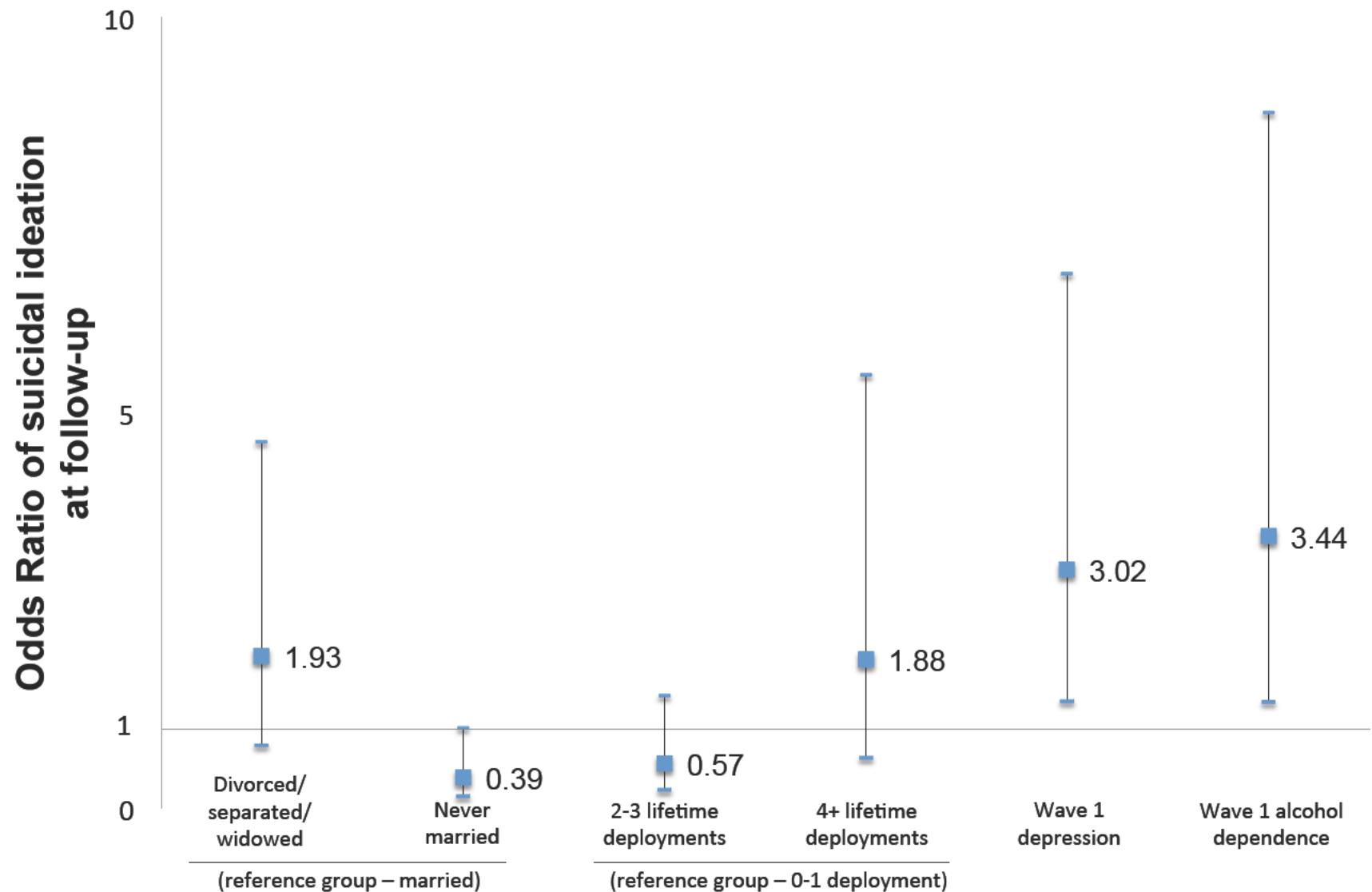
Wave 2 incident suicidal ideation

n=1587; percent suicidal ideation reported for participants meeting criteria

Crude odds of incident
suicidal ideation at wave 2

Adjusted* odds of incident suicidal ideation at wave 2

*model adjusted for gender, age, race, education, rank, and quantity of prior traumatic events
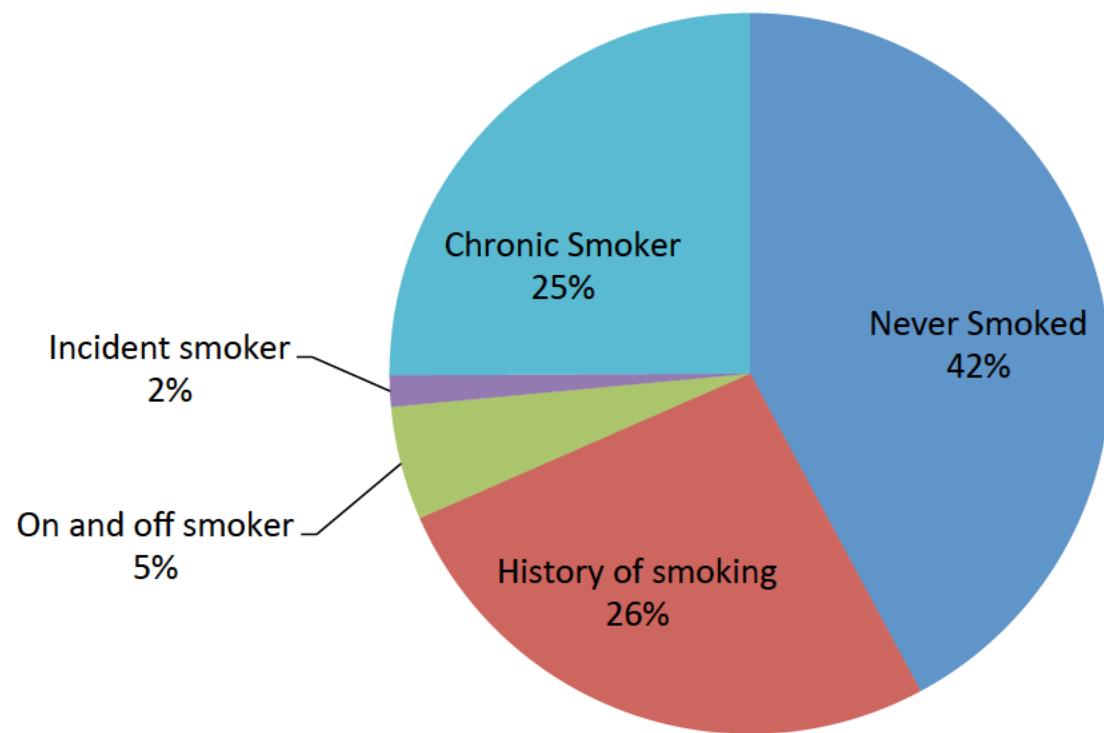
Conclusions

- alcohol dependence is independently and longitudinally associated with incident suicidal ideation

- depression is independently and longitudinally associated with incident suicidal ideation

- the effects of lifetime deployment upon incident suicidal ideation may be explained by alcohol dependence and depression

Tobacco use and risk of depression and suicidal ideation

Study aim

To investigate the relationship between smoking, depression and suicidal ideation in a representative sample of Ohio Army National Guard soldiers.

History of smoking at baseline

Chronic Smoker
25%

Incident smoker
2%

On and off smoker
5%

Never Smoked
42%

History of smoking
26%

Longitudinal sample at wave 2; n=1770

Smoking at baseline and suicidal ideation at one year follow-up

Smoked at baseline

Yes
31%

No
70%

Suicidal ideation at follow-up

Suicidal ideation at follow-up

Yes
6%

No
94%

Yes
3%

No
97%
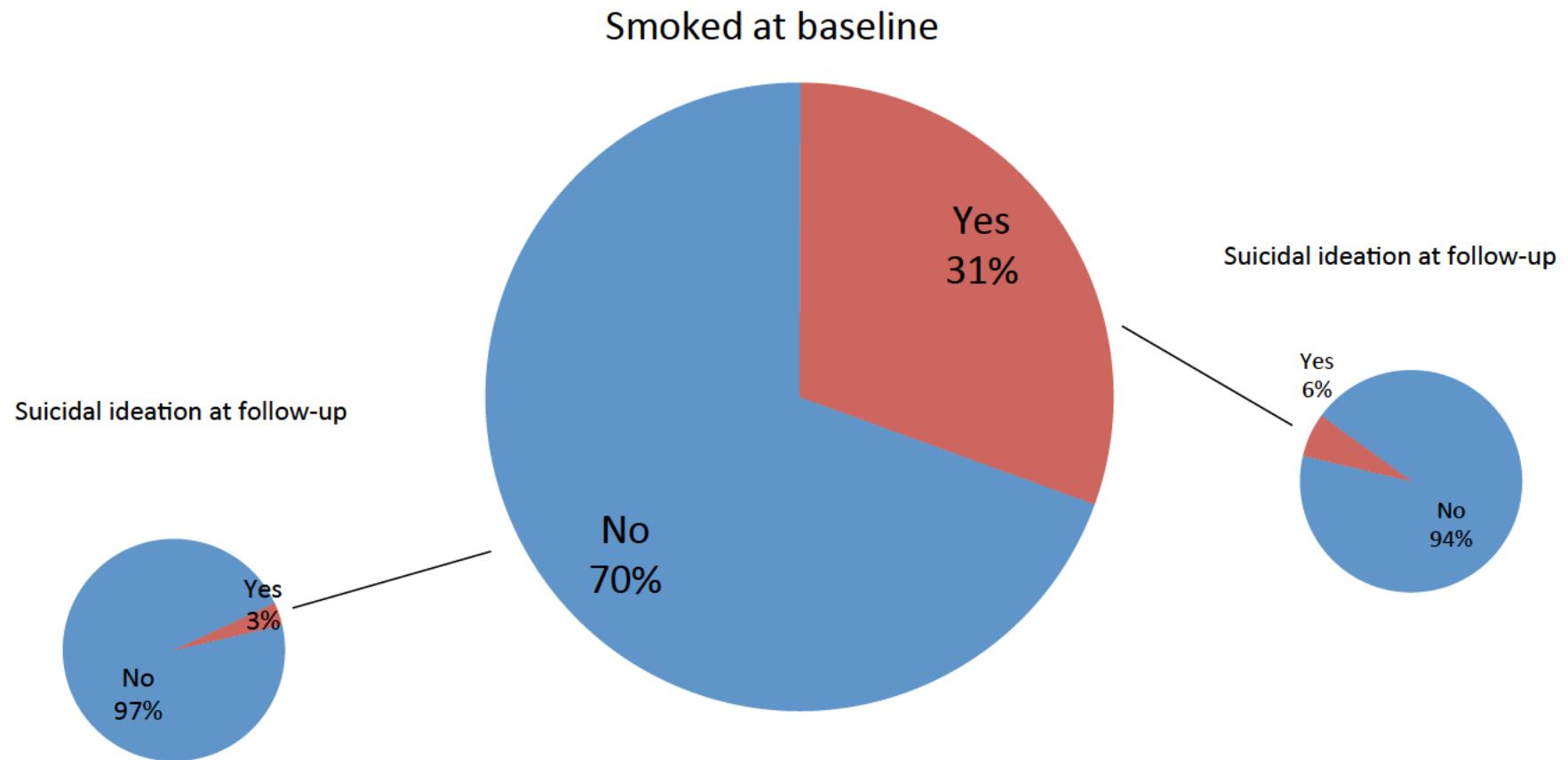
Longitudinal sample at wave 2; n=1766.

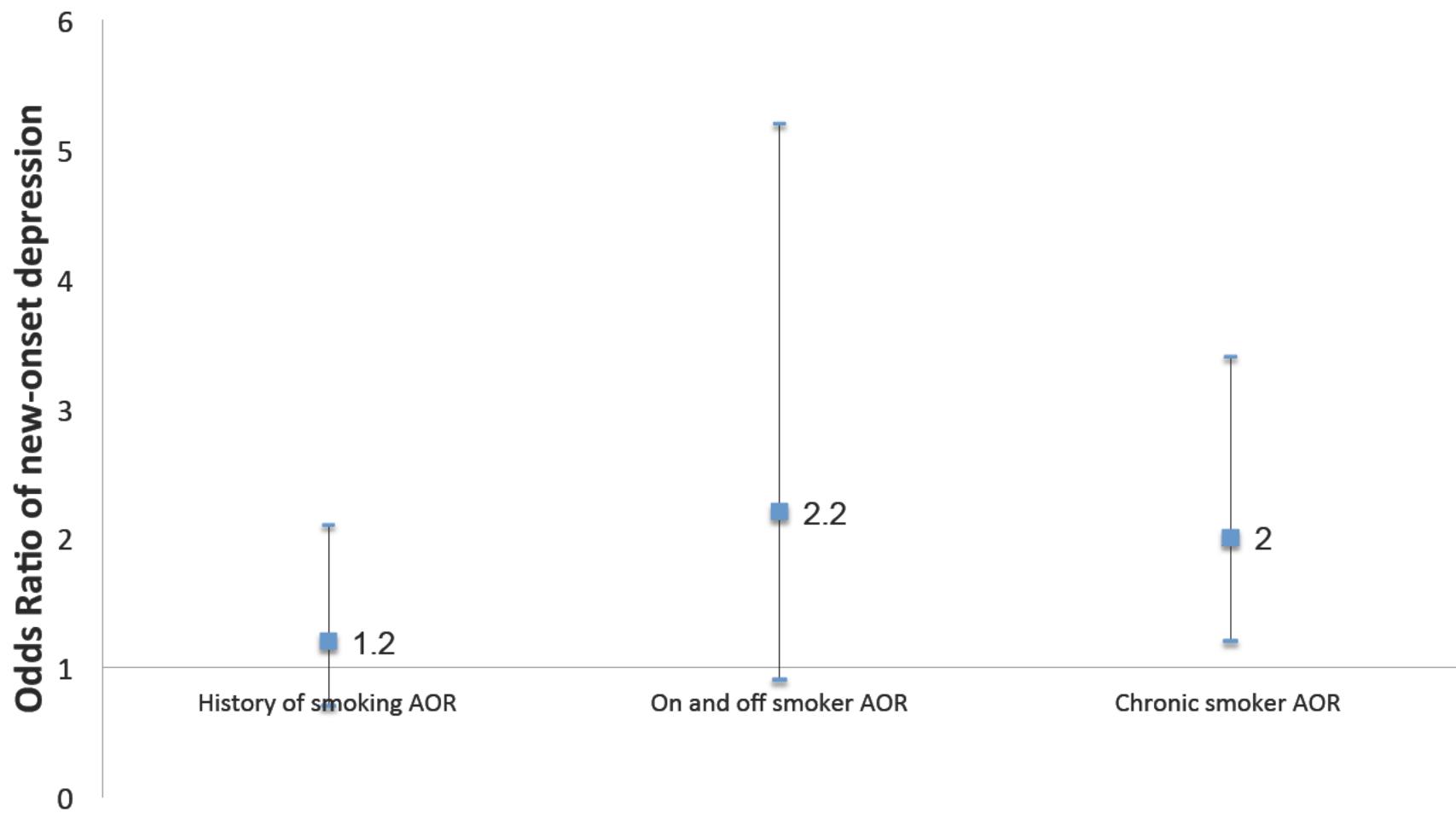Smoking at baseline is associated with new-onset depression one year later
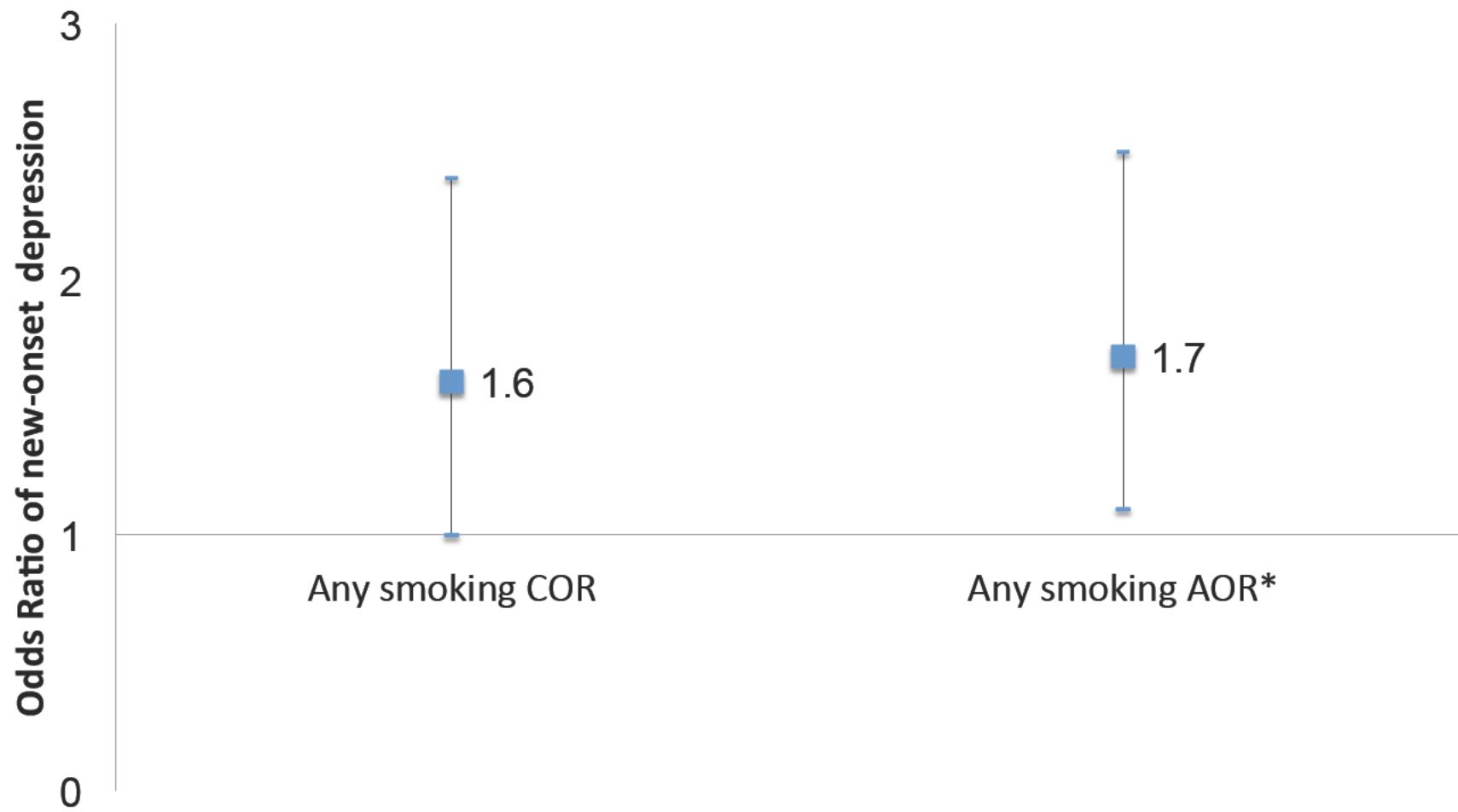
*Model is adjusted for age and gender

Chronic smokers are more likely to develop incident depression

*Model is adjusted for age and gender

Crude odds of suicidal ideation at one year follow-up
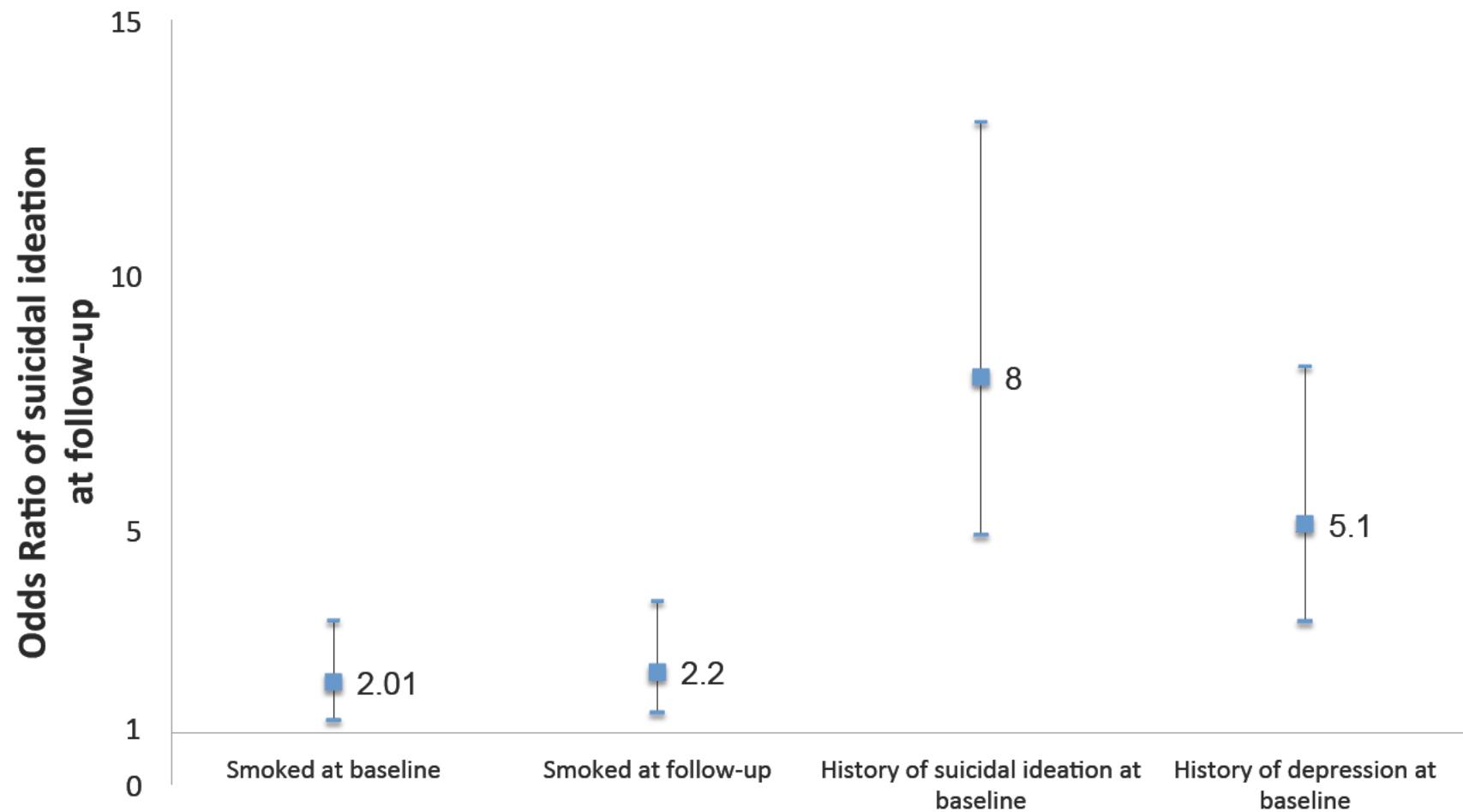
Odds Ratio of suicidal ideation at follow-up (y-axis: 0, 1, 5, 10, 15)

- Smoked at baseline: 2.01
- Smoked at follow-up: 2.2
- History of suicidal ideation at baseline: 8
- History of depression at baseline: 5.1

*Model adjusted for age, and gender in addition to above covariates; Depression at follow-up was associated with a crude odds ratio (OR) of 19.2 (11.5, 32.1)

Adjusted* odds of suicidal ideation at one year follow-up
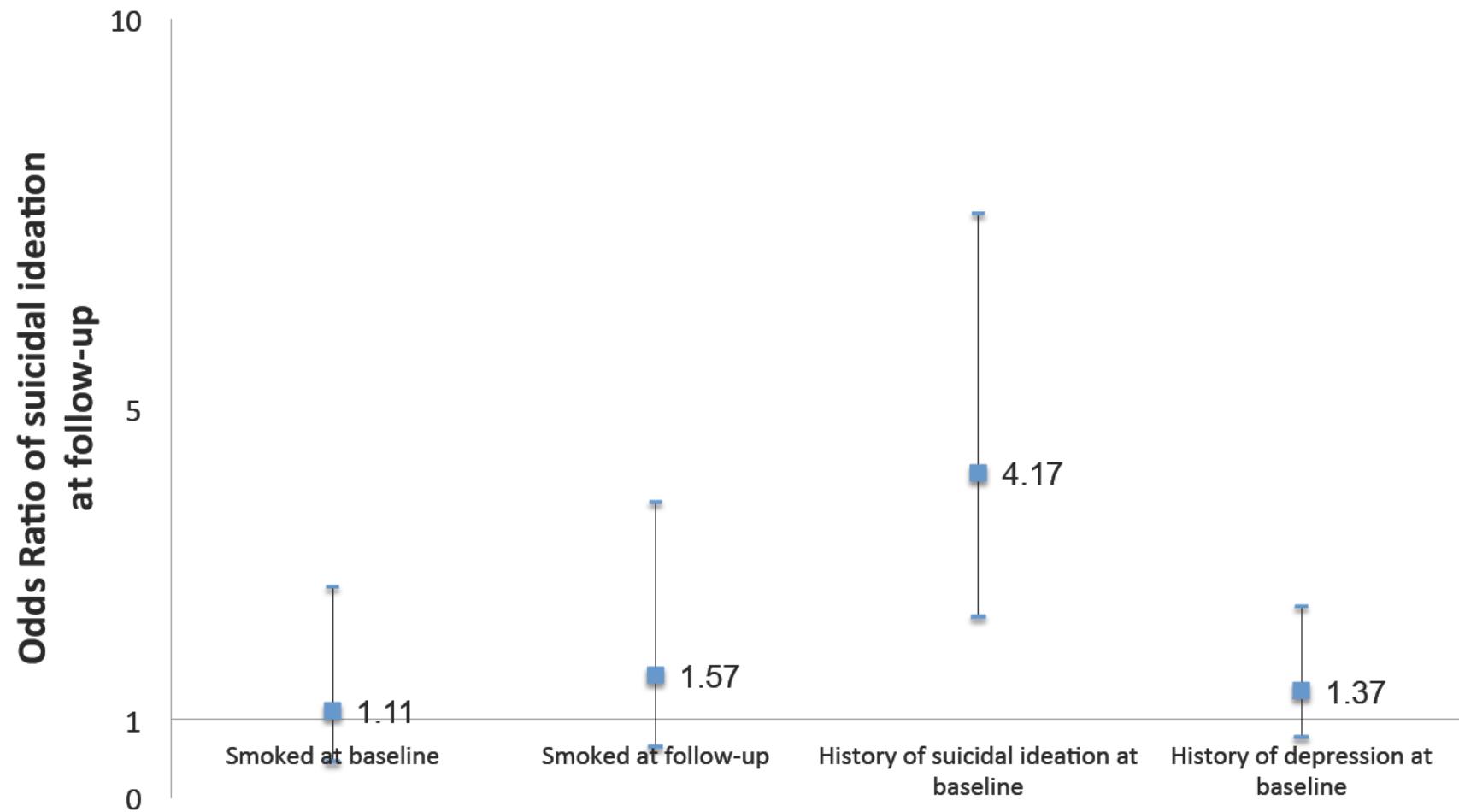
Odds Ratio of suicidal ideation at follow-up

10

5

1

0

Smoked at baseline — 1.11

Smoked at follow-up — 1.57

History of suicidal ideation at baseline — 4.17

History of depression at baseline — 1.37

*Model adjusted for age, and gender in addition to above covariates; Depression at follow-up was associated with an AOR of 13.2 (7.56, 23).

Conclusions

- baseline smoking, particularly chronic smoking, is longitudinally associated with increased odds of incident depression at 1 year follow-up

- baseline smoking is longitudinally associated with suicidal ideation at 1 year follow-up

- the relationship between smoking and suicidal ideation is explained by concurrent depression at follow-up

Key Findings

Key Findings (1)

1   mental health services utilization

- the majority of ONG soldiers who have mental health care need do not report accessing services

- ONG soldiers with alcohol use disorders were least likely to use services

- a little over half of those who access care report utilizing VA or DoD services

- the youngest group of veterans was least likely to use VA or DoD services

2   deployment and risky driving behavior

- deployment, particularly to conflict zones, is associated with risky driving behavior

- quantity of deployment trauma is associated with risky driving behavior in a dose-response fashion

- pre-deployment preparedness and post-deployment social support were associated with a reduction in odds of risky driving behavior

Key Findings (2)

3   PTSD and HIV risk behavior

- soldiers with PTSD may be at greater risk of HIV infection due to increased engagement in HIV risk behavior

- new-onset depression following trauma mediates this relationship

- integrated interventions to address mental health problems and reduce HIV risk behavior are needed

4   sexual trauma and psychopathology

- most reported sexual trauma did not occur in the context of deployment

- presence of any sexual trauma was strongly associated with PTSD and depression

- presence of sexual trauma is an important risk factor for PTSD and depression among National Guard soldiers

Key Findings (3)

5   differences between war- and civilian-related PTSD

- presence of etiologic and clinical heterogeneity
- soldiers who experience civilian-related events are more likely to report suicidal ideation than are soldiers with war-related events
- criterion A2 did not affect the prevalence of PTSD
- there is a consistent positive association between PTSD and suicidal ideation

Key Findings (4)

6   alcohol dependence and incident suicidal ideation

- alcohol dependence is independently and longitudinally associated with incident suicidal ideation
- depression is independently and longitudinally associated with incident suicidal ideation
- the effects of lifetime deployment upon incident suicidal ideation may be explained by alcohol dependence and depression

7   tobacco use and risk of depression and suicidal ideation

- baseline smoking, particularly chronic smoking, is longitudinally associated with increased odds of incident depression at 1 year follow-up
- baseline smoking is longitudinally associated with suicidal ideation at 1 year follow-up
- the relationship between smoking and suicidal ideation is explained by concurrent depression at follow-up

PTSD Genetics Repository and Gene Association Studies with ONG

Genetics of PTSD Risk and Resilience

Table 1	PTSD trauma	Alleles	Total (n)	PTSD (n)	control (n)	traum contr	finding
Gelernter e al 1999	combat	*DRD2*	134	52	82	no	*Negative*
Segman, 2002	mixed	*SLC6A3 (DAT)*	206	102	104	yes	*Positive*
Lee et al, 2005	civilian mixed	*5-HTTLPR*	297	100	197	no	*positive*
Kilpatrick et al., 2007	civilian disaster	*5-HTTLPR*	589	19	570	yes	*interaction w/ level of exposure & support*
Koenen et al., 2009	civilian disaster	*5-HTTLPR*	589	19	570	yes	*interaction w/ level of exposure & support*
Amstadter et al., 2009	civilian disaster	*RSG2*	589	19	570	yes	*interaction w/ level of exposure & support*
Binder , Ressler et al., 2008	civilian mixed	*FKBP5*	762			85% trauma	*quant trait (PTSD score) interaction w*
Xie et al., 2009	civilian mixed	*5-HTTLPR*	1252	229	1023	yes	*Case-control, G x E*
Ressler et al., 2011	civilian mixed	*ADCYAP1R1*	763			yes	*PACAP -Women only association w/PTSD*

Candidate Gene Association Studies: Case-Control & Quantitative Trait

Gene x Environment interactions in psychiatric genetics: the role of childhood adversity

Serotonin Transporter Promoter

Depression
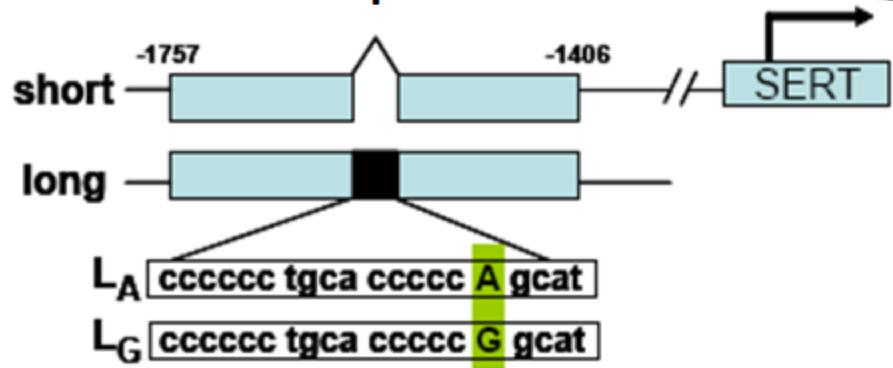
Caspi et al., 2002

"PACAP" (*ADCYAP1R1* gene) associates w/ PTSD only in women (African American)
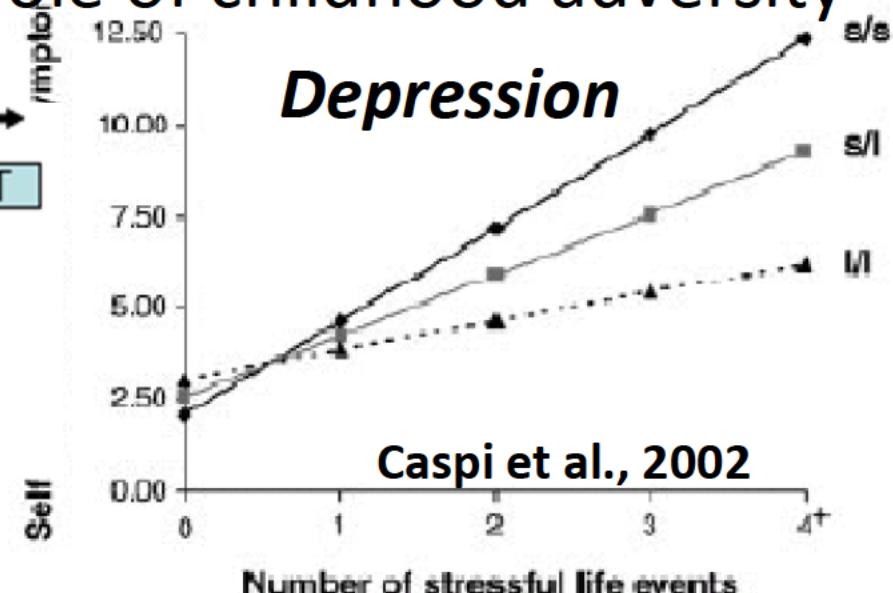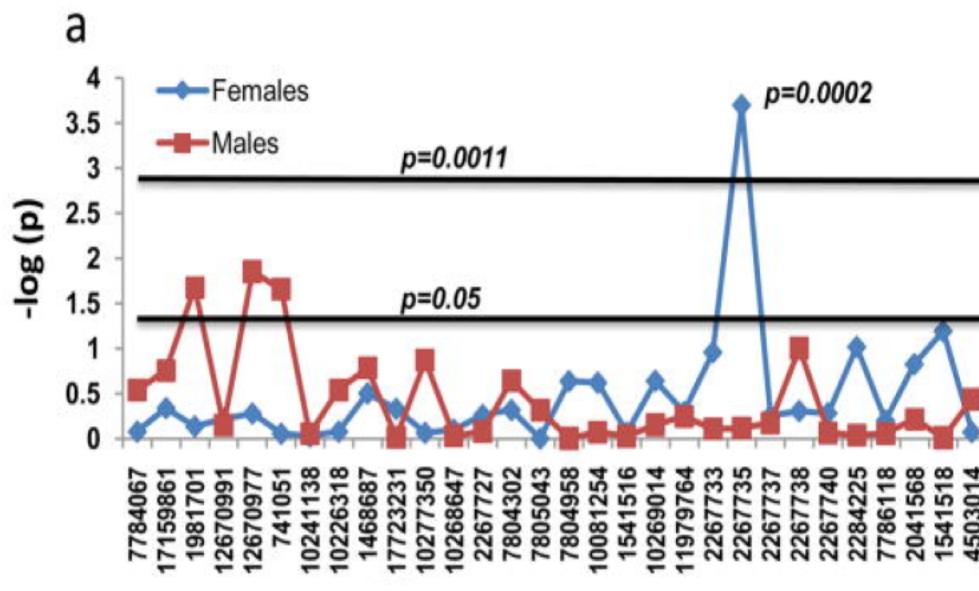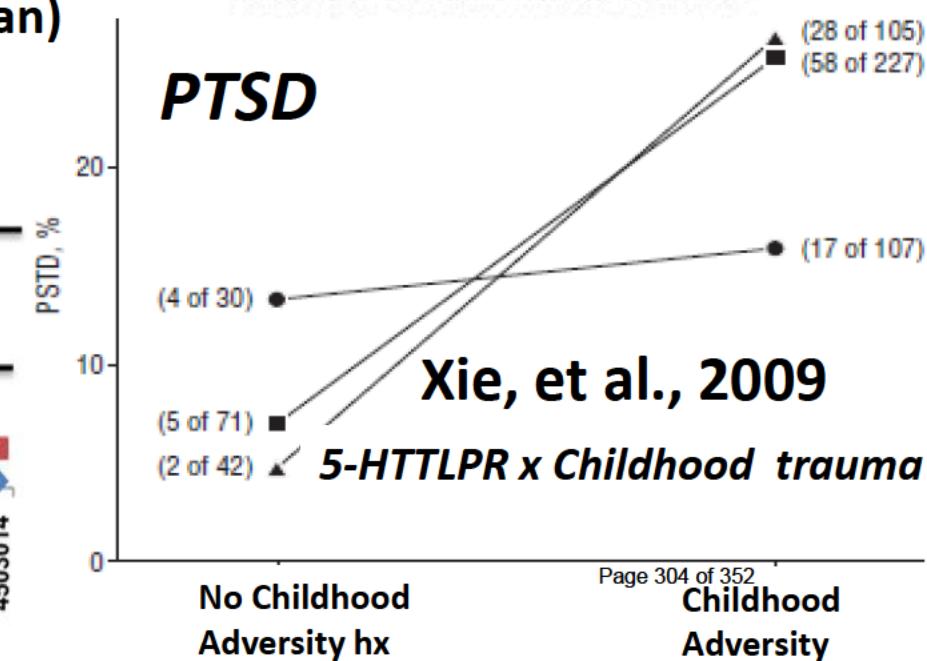
PTSD

Xie, et al., 2009

5-HTTLPR x Childhood trauma

FKBP5: interaction with Child Abuse predicting adult PTSD

Binder, Ressler (2008)

Urban, African American sample N=1200
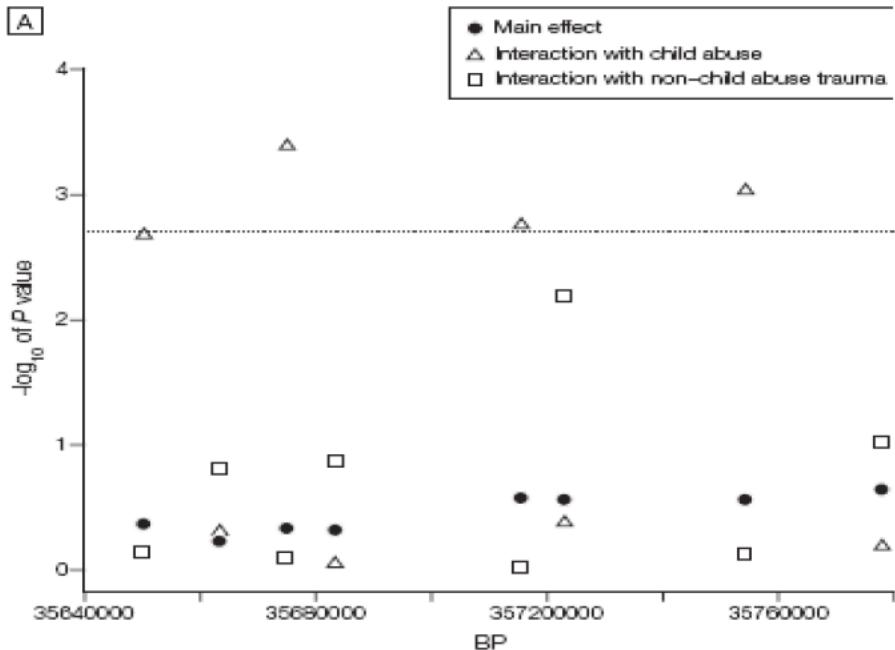
FKBP5 is glucocorticoid receptor chaperone, SNPs also associated with HPA axis function, depression following stress and trauma

Genetics of PTSD risk and resilience: data from our translational core

Serotonin Transporter x Childhood Trauma in PTSD

Data from our translational core
Civilian cohort 415 trauma-exposed Detroit women:
Greater risk for adult PTSD in women exposed to childhood and adult traumas: *only in those who carry function S-allele of the Serotonin Transporter gene*
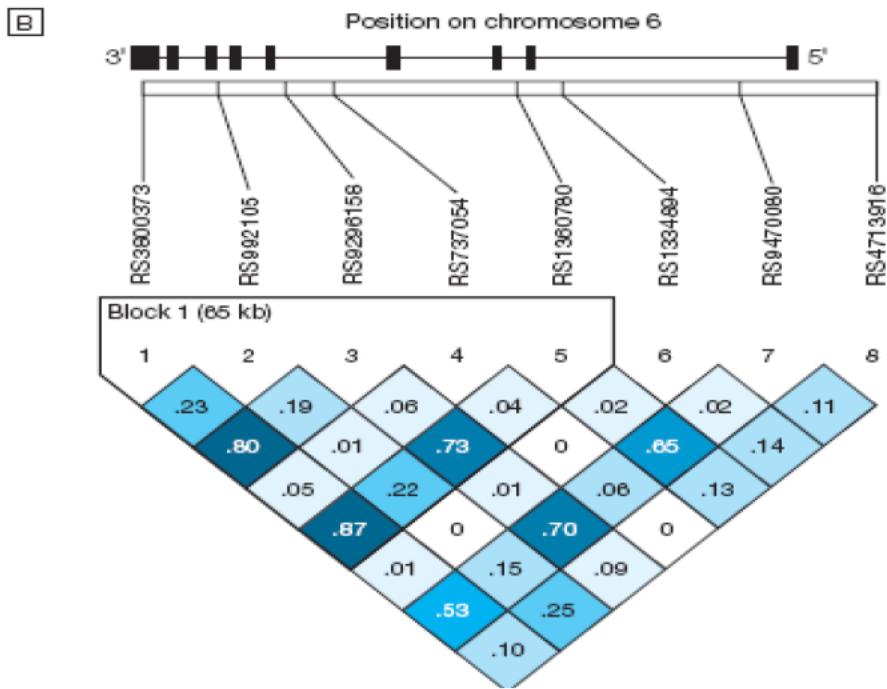
Step 1: R2=0.02	Sig.	OR	95% C.I.	
LA / LA vs S'-carrier	.051	1.79	.997	3.200
age	.363	1.01	.985	1.041
FBI crime rate	.594	1.03	.994	1.006

Step 2 R2=0.18	Sig.	OR	95% C.I.	
LA / LA vs S'-carrier	.022	2.08	1.110	3.900
Childhood Trauma	.000	4.85	2.914	8.067

Step 3: R2=0.21	Sig.	OR		
LA / LA vs S'-carrier	.877	1.07	.476	2.385
Childhood Trauma	.342	1.67	.581	4.779
SERT x CAE	.025	3.96	1.185	13.256

"Functional" S
■ S'S'
● S'L$_A$
● L$_A$L$_A$

% Lifetime PTSD diagnosis

no hx   Childhood Trauma
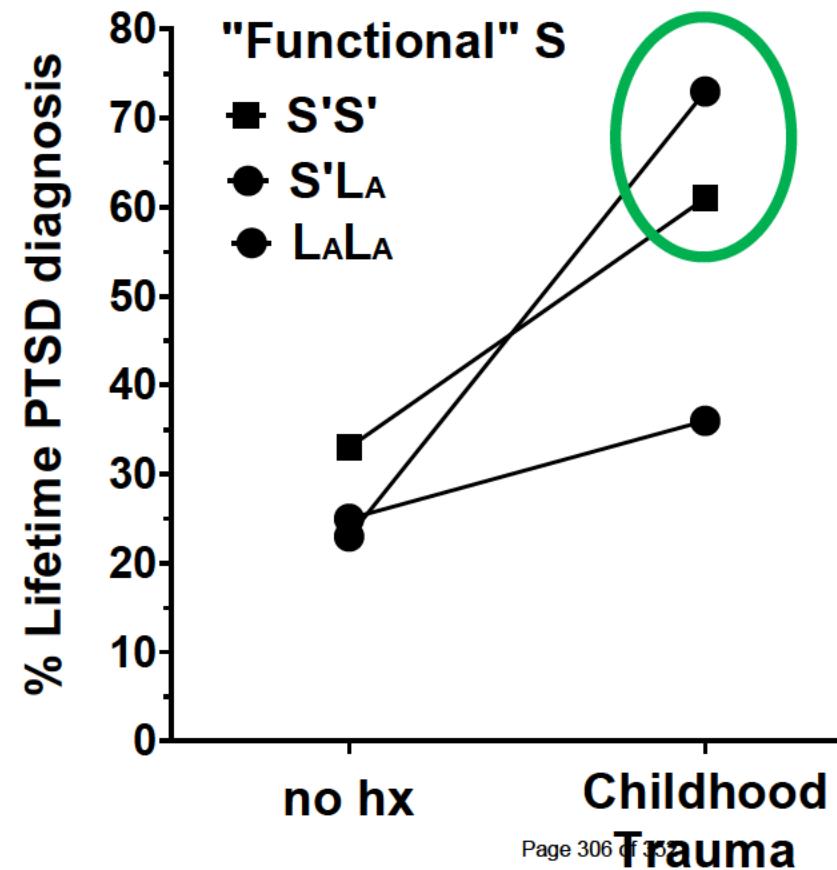
PTSD Risk and resilience:
gene x environment interactions

Predeploy Trauma

Sex Assault. Combat, Assault, Accident, Disaster, etc

Deployment Trauma *characteristics*

Optimism, Neuroticism HPA axis, SNS Threat detection

5-HT HPA NE GABA Glut DA etc

Genetic Background

Diathesis **"Vulnerable Phenotype"**

Psycho-Pathology PTSD

Childhood Adversity

Physical, Sexual Emotional Abuse, Neglect, Violence to mother, etc.

Social Support Context, SES

Support, Discrimination Poverty, Education, etc

Intrusive sx Avoidant sxs Hyperarousal sx etc..

Biological repository: genomic DNA Purification from saliva

Gel electrophoresis - high quality genomic DNA from saliva

UV spectroscopy (nanodrop)
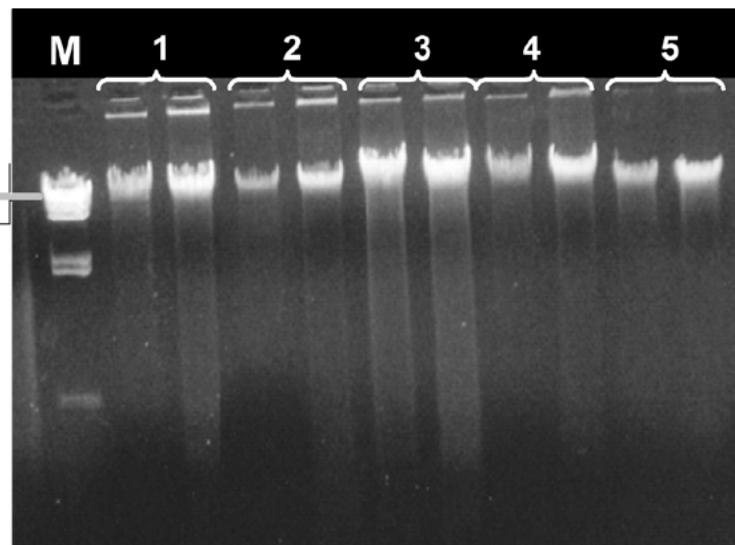
DNA – UV Absorbance

- Fragment sizes > 23 Kb, low degradation
- >800 samples to date – yield 10 - 150 ug (mean 35 ug)
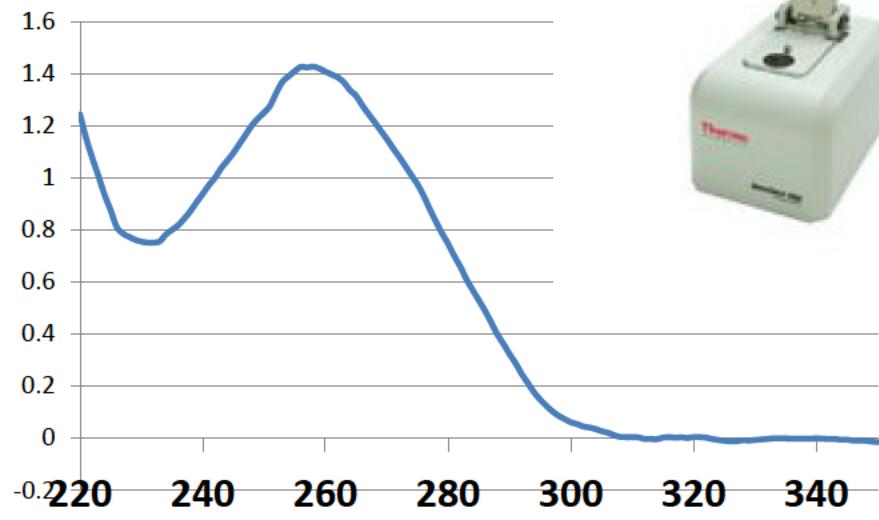
High Yield – high quality DNA

Concent (ug / ul)	OD 260	OD 280	OD260 / OD 280
74.9 ± 13.7	1.41 ± .82	0.77 ± .15	1.82 ± .05

Biological repository: specimen and data work flows

Genetic specimens (saliva) collected in home by soldiers (kit mailed SRBI) → **Specimens directly mailed to Ann Arbor VA Repository, tracked w/LIMS** → **Genomic DNA purified, QC/QA, & archival w/ LIMS in multiple aliquots**

Custom 4800 SNP panel Microarrays (Illumina

Post-Deployment psychosocial data e.g. (PTSD sxs) collected SRBI → **De-identified psychosocial database**

SNP genotyping Illumina arrays run data cleaning QC/QA

Genetics & Psychosocial Databases are Merged Gene Association & Gene x Environment Studies with PTSD

To protect participant confidentiality, personal identifiers are never provided to the Genetics repository, and genetic information linkable to individuals is never provided to the psychosocial collection staff

Genetic analyses – candidate gene

5-HT
HTR2A
TPH2
SLC6A4
HTR3A
HTR2C
MAOA
SLC6A3
HTR1B
HTR3B
MAOB
HTR1A
TPH1

Other
CACNA1C
ARNTL
DISC1
DGKH
MAMDC1
PLXNA2
FLJ45872
ADAM18
CSMD1
DFNB31
MTHFR

Adrenergic
DBH
SLC6A2
ADRA1A
ADRA1B
TH
ADRBK2
ADRB2
ADRA2A
ADRA2B
ADRA2C
ARRB2

Cell Signalling
SNAP25
RGS2
GAP43
MAPK1
NTSR1
ADCY7
GSK3B
FOSL2
NRCAM
BCL2
NR1D1
CREB1
NTSR2
CREB
CALB1
CIT
RGS4
CDK5R1
CREB5
CSNK1E
FEV
FOS
FOSL1
JUN

Circadian
NPAS2
CLOCK
CCKAR
PER3
TIMELESS
CCK
Per2
BHLHB2
HCRTR1

Dopamine
COMT
DRD2
DRD4
DRD1
DRD3
SLC18A1

Peptide
OXTR
OXT
TAC1
AVPR1A
BDNF

HPA Axis
FKBP5
NR3C1
CRH
CRHR1
CRHR2
CRHBP
NPY1R
NPY
NPY2R
TULP1
CCKBR
GAL
CLPS
NPY5R
NR3C2

GABA
GABRB2
GABRA2
GAD2
GAD1
GABRB1
SLC6A11
GABRA1
GABBR1
GABRA6
GABRA3
DBI
GABRB3

Custom Illumina iSelect Infinum Microarray
~4800 SNPs
24 samples/
chip

Opioid
OPRM1
OPRD1
OPRK1
PDYN
PNOC
OPRL1
PENK
POMC

Infammatory
IL1R2
IL6
F5
IL1B
ACE1
IL10
IL1A
ACHE
TNF

Glutamate
CAMK2A
GRIN2A
GRIN2B
ANK3
GRIK1
DAOA
GRM1
GRIK4
DAO
GRIN1
SLC1A1

# Currently available Sample of ONG soldiers for preliminary analyses:

- N=944 genomic DNA specimen received
- N=937 passed QC (DNA quality, call rate >99%,)
- (HWE – SNPs inclusion)
- W1 and/or W2 survey data from N=719
- Ancestry European   N=663 (92%)
                African or mixed N= 38 (3%)
- Male N=607 (85%) Female N=109 (15%)
- PTSD measures available (phenotype)
        W1 PCL non-deploy   N=649
        W1 PCL Deployment   N=302

        W2 PCL non-deploy   N=617
        W2 PCL Deployment   N=333

Distributions of Phenotype (PTSD symptoms - PCL), Adverse Childhood Events types, & total lifetime traumas in the genetics sub-sample
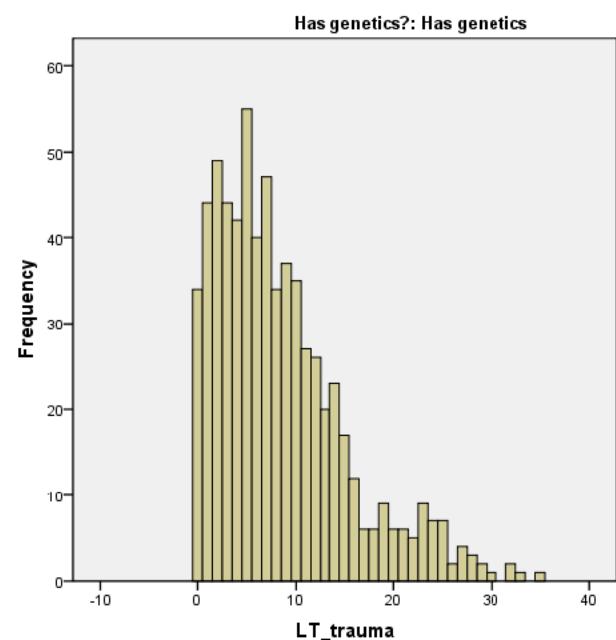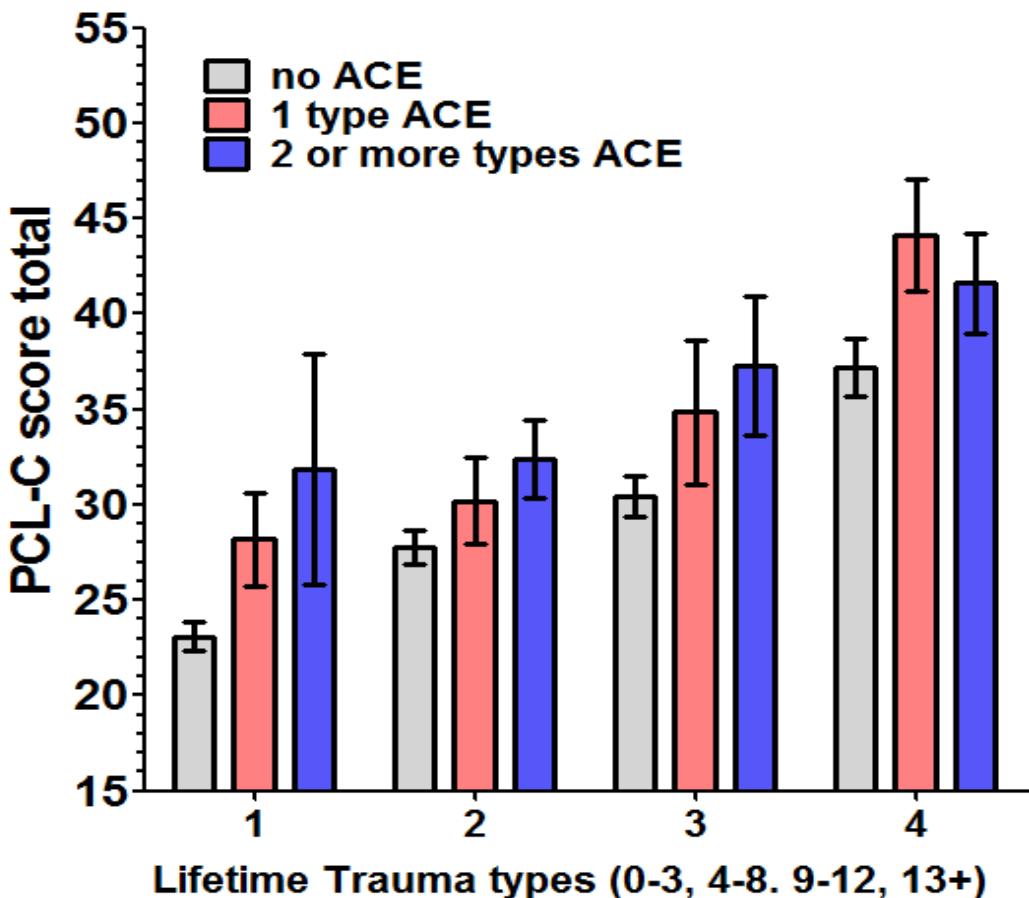
PCL score (highest)
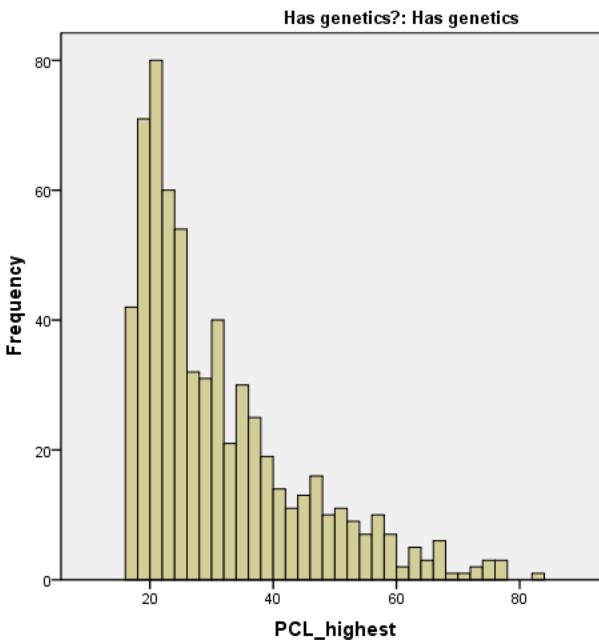
Types of ACE
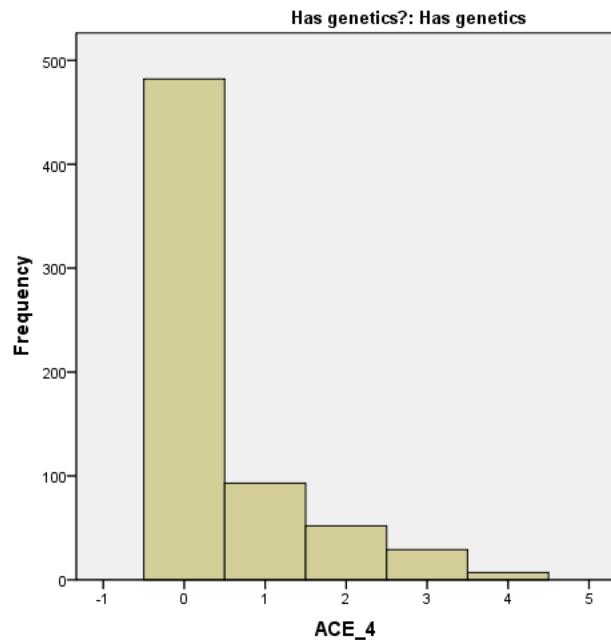
Lifetime traumas

Contribution of Adverse Childhood Events (4 types), and total reported types of lifetime trauma and PTSD symptoms (highest PCL)

ANOVA

ACE $p < .001$, eta2=.04

LT trauma $p < .001$, eta2=.09

ACExLTtrauma Interaction ns

Correlation ACE and LT trauma r=0.12, p<.001

Models for gene Association and Gene x Environment interactions

- Main Effects of SNPs on PTSD symptoms
  - Y = b0 + b1 SNP + b2 gender
- ME Gene, ME Adverse Childhood Event, Gene x CAE interaction
  - Y = b0 + b1 SNP + b2 CAE + b3 SNP x ACE + b4 gender
- ME Gene, ME Adverse Childhood Event, Gene x CAE interaction, Lifetime Trauma load, Gene x LT trauma load interaction
  - Y = b0 + b1 SNP + b2 CAE + b3 SNP x ACE + b4 LT trauma + b5 SNP x LT trauma + b6 gender

Replications of G x E interactions in PTSD in ONG: *FKBP5 SNPs*

Total sample N=592

ACE p value	gene	SNP name	risk	SNP p value	SNP x ACE p
0.001	**FKBP5**	rs1360780	A	0.253	**0.004**
0.001	**FKBP5**	rs3800373	C	0.401	**0.007**
0.001	**FKBP5**	rs9296158	A	0.581	**0.002**
0.001	**FKBP5**	rs9470080	A	0.284	**0.007**

European ancestry only N=551

ACE p value	gene	SNP name	risk	SNP p value	SNP x ACE p
0.001	**FKBP5**	rs1360780	A	0.562	**0.071**
0.001	**FKBP5**	rs3800373	C	0.692	**0.021**
0.001	**FKBP5**	rs9296158	A	0.827	**0.017**
0.001	**FKBP5**	rs9470080	A	0.459	**0.051**
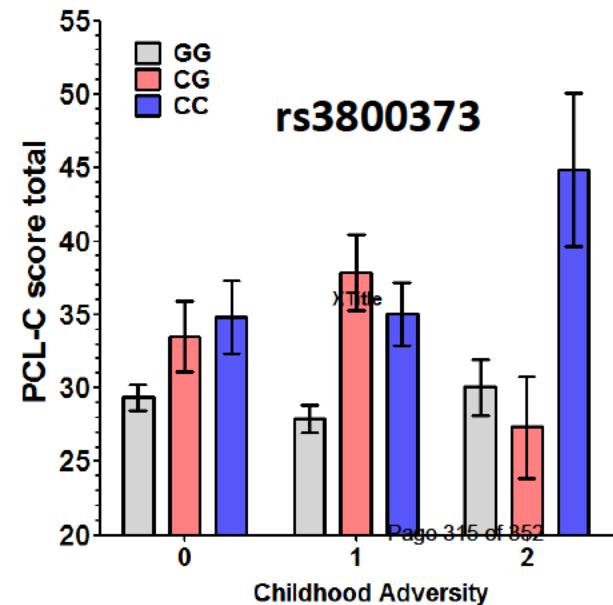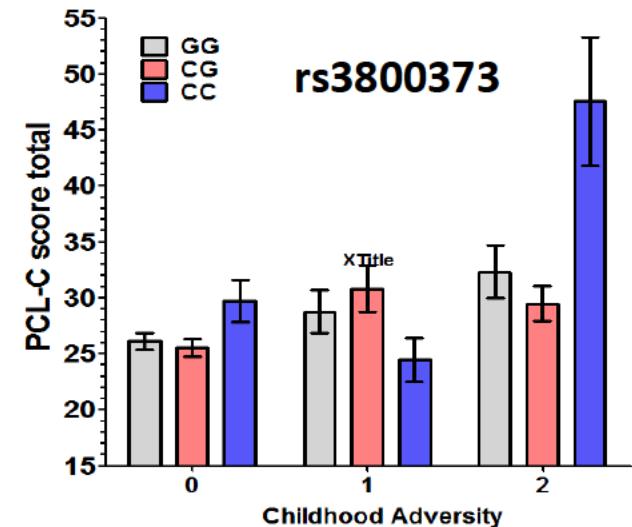
Replications of G x E interactions in PTSD in our ONG Cohort Sample

- **FKBP5** - replicated G x E ($p<.005$ in total sample, $p<.05$ in N=549 European ancestry. N=38 African or mixed ancestry, larger N will allow stratified analyses

- **RGS2** - ns main effect or G x E

- **ADCYAP1R1** - ns main effect or G x E in sample currently N=109 females, larger N for stratified analyses

- **5-HTTLPR** - genotyping (PCR-based) ongoing

Main Effects of SNPs for PTSD

Significant after Bonferroni correction (P < 1.1 x E-05):
   DISC1

Highest PCL total score (n=551 European Ancestry)

CHR	SNP		A1	TEST	NMISS	BETA	P
1	rs821647	**DISC1**	G	ADD	589	-3.52	**1.55E-05**
1	rs3753396	**CPH**	G	ADD	589	3.033	**9.39E-04**
6	rs2067997	**FKBP5**	G	ADD	589	3.427	**8.21E-04**
16	rs12922100	**MAPK3**	A	ADD	589	6.277	**8.62E-04**

Highest PCL Hyperarousal score (n=551 European Ancestry)

CHR	SNP	BP	A1	TEST	NMISS	BETA	P
1	rs821647	**DISC1**	G	ADD	589	-1.269	**4.40E-06**
5	rs2290638	**HOMER**	C	ADD	589	0.9633	**9.39E-04**
6	rs1051952	**FKBP5**	C	ADD	589	0.8764	**6.89E-04**
6	rs2067997	**FKBP5**	G	ADD	589	1.258	**2.95E-04**

SNP x ACE Interactions
(controlling for main effect ACE)

Significant after Bonferroni correction (P < 1.1 x E-05)
none

Highest PCL total score (n=551 European Ancestry)

CHR	SNP	Gene Symbol	A1	TEST	BETA	P
5	rs2400707	**NR3C1**	A	SNP x ACE	-3.328	**1.5E-04**
5	rs1042714	**ADRB2**	C	SNP x ACE	-3.236	**2.0E-04**
5	rs11168068	**ADRB2**	G	SNP x ACE	-3.272	**2.2E-04**
5	rs11168070	**ADRB2**	C	SNP x ACE	-3.24	**2.2E-04**
5	rs1432622	**ADRB2**	A	SNP x ACE	-3.272	**2.1E-04**
5	rs1432623	**ADRB2**	G	SNP x ACE	-3.272	**1.8E-04**
5	rs2053044	**ADRB2**	A	SNP x ACE	-3.295	**2.1E-04**
6	rs2143404	**FKBP5**	A	SNP x ACE	-4.131	**4.2E-04**
6	rs13192954	**FKBP5**	G	SNP x ACE	-8.54	**9.1E-04**
6	rs4870266	**OPRM1**	A	SNP x ACE	4.71	**7.2E-04**
8	rs7820517	**SLC18A1**	A	SNP x ACE	4.081	**2.2E-04**
8	rs2576573	**PENK**	A	SNP x ACE	-2.688	**3.5E-04**
8	rs2609998	**PENK**	A	SNP x ACE	-2.681	**3.6E-04**

SNP x ACE Interactions
(controlling for main effects of ACE &LT trauma)

**Significant after Bonferroni correction (P < 1.1 x E-05):**

ADRB2: beta adrenergic receptor

Highest PCL total score (n=551 European Ancestry)

CHR	SNP	Gene Symbol	A1	TEST	BETA	P
5	rs1432622	ADRB2	A	SNP x ACE	-3.659	5.41E-06
5	rs1432623	ADRB2	G	SNP x ACE	-3.659	5.41E-06
5	rs11168068	ADRB2	G	SNP x ACE	-3.659	5.41E-06
5	rs2400707	ADRB2	A	SNP x ACE	-3.715	3.82E-06
5	rs2053044	ADRB2	A	SNP x ACE	-3.665	5.20E-06
5	rs11168070	ADRB2	C	SNP x ACE	-3.627	6.74E-06
5	rs1042714	ADRB2	C	SNP x ACE	-3.626	6.66E-06

G x E interaction with Childhood Adversity including LT trauma load - significant w/ Bonferoni (p < 10^{-5})

G x E (ACE and LT trauma)
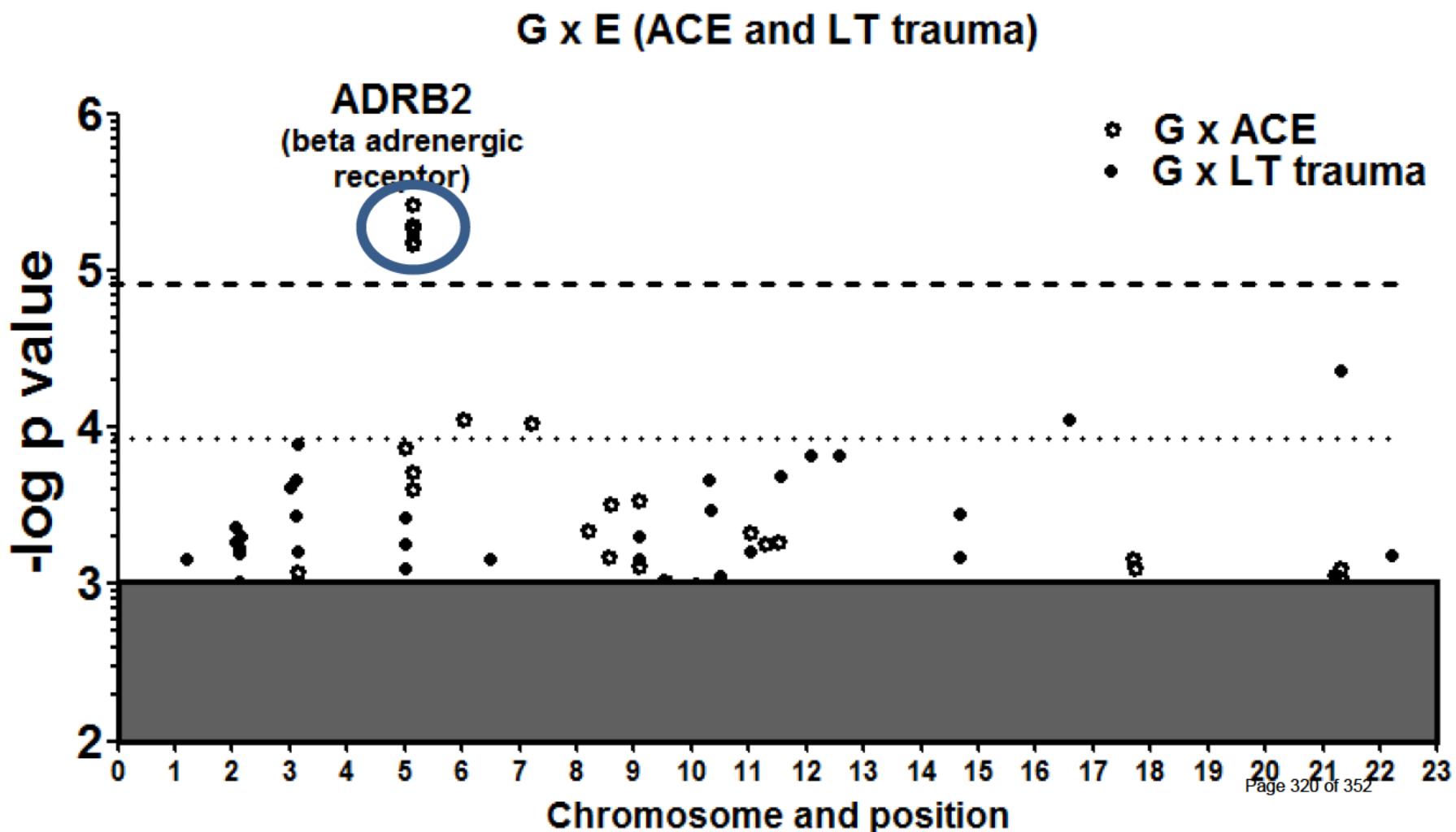
Three Major Haplotypes of the β2 Adrenergic Receptor Define Psychological Profile, Blood Pressure, and the Risk for Development of a Common Musculoskeletal Pain Disorder

Luda Diatchenko,[1*] Amy D. Anderson,[2] Gary D. Slade,[3] Roger B. Fillingim,[4] Svetlana A. Shabalina,[5] Tomas J. Higgins,[1] Swetha Sama,[1] Inna Belfer,[6,7] David Goldman,[6] Mitchell B. Max,[7] Bruce S. Weir,[2] and William Maixner[1]

[1]University of North Carolina, Center for Neurosensory Disorders, North Carolina
[2]University of Washington, Department of Biostatistics, Seattle
[3]University of Adelaide, Australian Research Centre for Population Oral Health, Adelaide
[4]University of Florida College of Dentistry, Gainesville
[5]Computational Biology Branch, NCBI, NIH, Bethesda, Maryland
[6]Laboratory of Neurogenetics, NIAAA, NIH, Rockville, Maryland
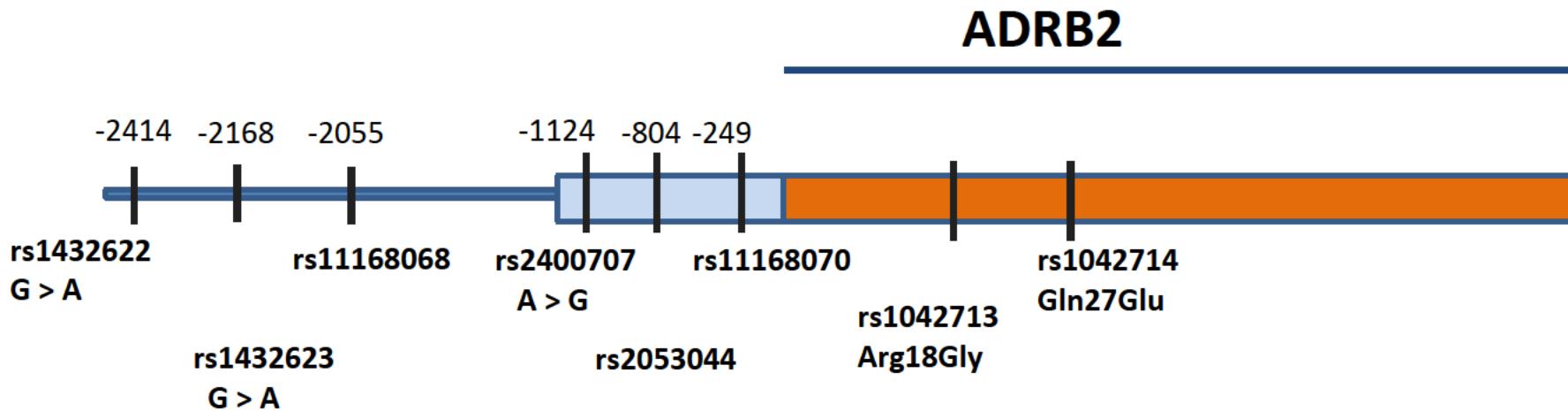[7]Pain & Neurosensory Mechanisms Branch, NIDCR, NIH, Bethesda, Maryland

Adrenergic receptor β2 (ADRB2) is a primary target for epinephrine. It plays a critical role in mediating physiological and psychological responses to environmental stressors. Thus, func... etiological pathways that imply the need for tailored treatment options.   © 2006 Wiley-Liss, Inc.

KEY WORDS: adrenergic receptor β2; haplo-

Beta 2 Adrenergic Receptor SNPs showing G x E interaction

mRNA transcript

ADRB2

-2414 -2168 -2055 -1124 -804 -249

rs1432622
G > A

rs11168068

rs2400707
A > G

rs11168070

rs1042714
Gln27Glu

rs1432623
G > A

rs2053044

rs1042713
Arg18Gly

SNP	P value
rs1432622	5.41×10^{-6}
rs1432623	5.41×10^{-6}
rs11168068	5.41×10^{-6}
rs2400707	3.82×10^{-6}
rs2053044	5.2×10^{-6}
rs12654778	0.000247
rs11168070	6.74×10^{-6}
rs1042713	0.000193
rs1042714	6.6×10^{-6}

- **Beta 2 Adenergic Receptor central player in sympathetic nervous system**
- May be important in Brain-Immune system cross-signalling (Elenkov, 2008)
- Haplotypes of these SNPs predict depressed mood, pain sensitivity, and chronic pain (Diatchenko, 2006, 2008)
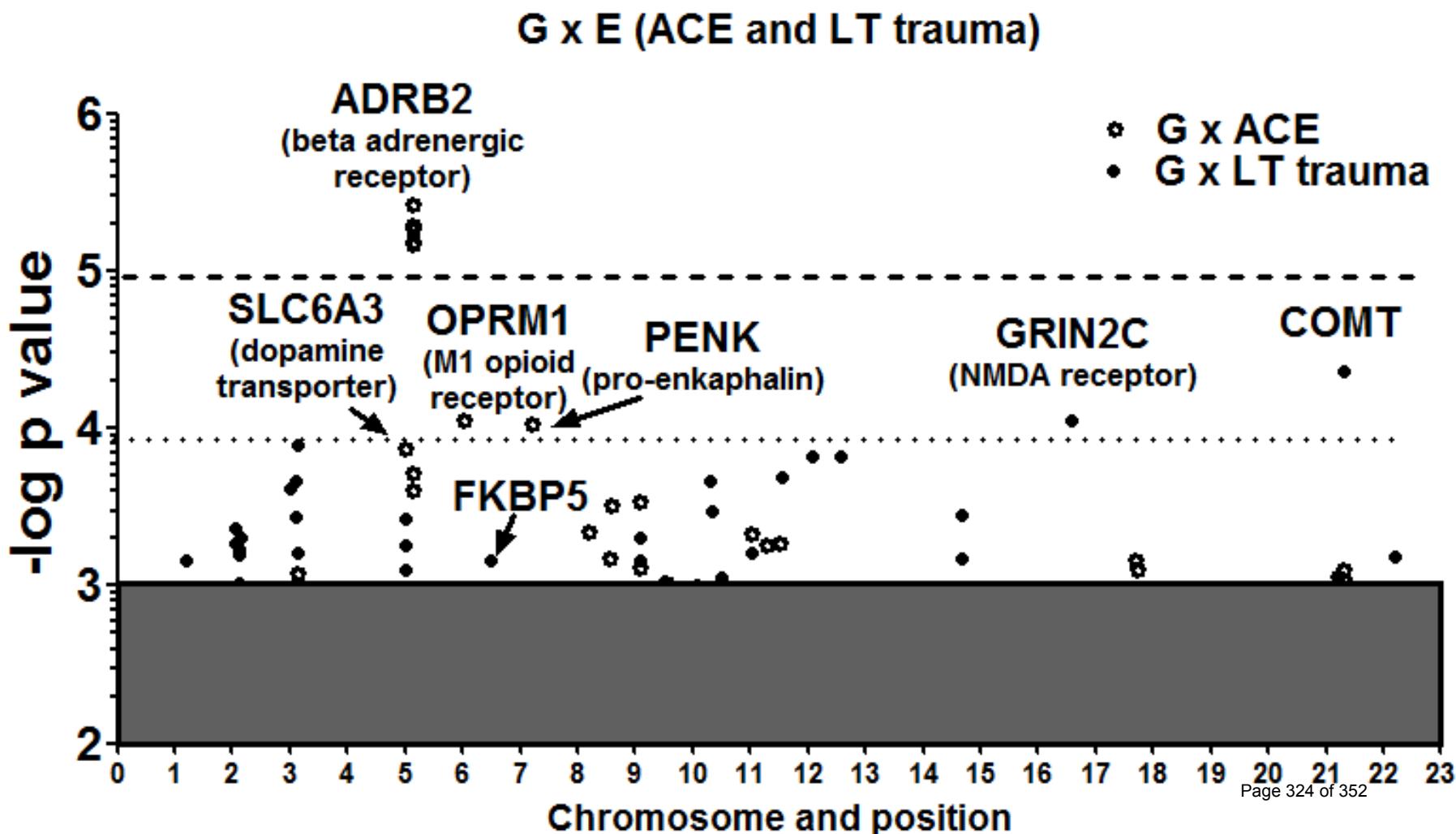
SNP x ACE Interactions
(controlling for main effects of ACE &LT trauma)

Highest PCL total score (n=551 European Ancestry)

CHR	SNP	Gene Symbol	A1	TEST	BETA	P
3	rs6440168	SLC9A9	A	SNP x ACE	2.558	5.91 E-04
5	rs12654778	ADRB2	A	SNP x ACE	2.85	2.47 E-04
5	rs1042713	ADRB2	A	SNP x ACE	2.901	1.93 E-04
6	rs4870266	OPRM1	A	SNP x ACE	4.852	1.34 E-04
8	rs2576573	PENK	A	SNP x ACE	-2.698	8.95 E-05
8	rs2609998	PENK	A	SNP x ACE	-2.691	9.41 E-05
8	rs7820517	SLC18A1	A	SNP x ACE	3.441	6.72 E-04
9	rs2808707	NTRK2	A	SNP x ACE	-2.722	4.59 E-04
11	rs2049048	BDNF	A	SNP x ACE	-3.972	4.7 E-04
11	rs3891484	HTR3B	G	SNP x ACE	3.48	5.44 E-04
21	rs2832484	GRIK1	G	SNP x ACE	2.817	6.81 E-04
21	rs2243436	GRIK1	A	SNP x ACE	2.766	7.89 E-04
21	rs2832489	GRIK1	G	SNP x ACE	2.766	7.89 E-04
21	rs420121	GRIK1	A	SNP x ACE	-2.986	9.19 E-04
22	rs11089599	SYN3	A	SNP x ACE	2.974	8.80 E-04

SNPs showing G x E interaction with Childhood Adversity – P values < 10^{-4}

G x E (ACE and LT trauma)

- ○ G x ACE
- ● G x LT trauma

ADRB2 (beta adrenergic receptor)

SLC6A3 (dopamine transporter)

OPRM1 (M1 opioid receptor)

PENK (pro-enkaphalin)

FKBP5

GRIN2C (NMDA receptor)

COMT

-log p value

Chromosome and position

SNP x LT trauma Interactions
(controlling for main effects of ACE &LT trauma)
Highest PCL total score (n=551 European Ancestry)

CHR	SNP	Gene Symbol	A1	TEST	BETA	P
1	rs3811014	NGFB	G	SNP X LT trauma	0.5065	6.90 E-04
2	rs1143634	IL1B	A	SNP X LT trauma	-0.4494	5.02 E-04
2	rs1143637	IL1B	A	SNP X LT trauma	-0.4437	5.91 E-04
2	rs1143639	IL1B	A	SNP X LT trauma	-0.442	6.311 E-04
3	rs935519	SLC9A9	A	SNP X LT trauma	-0.5256	1.31 E-04
3	rs4358295	GAP43	A	SNP X LT trauma	-0.5189	2.22 E-04
3	rs9878482	SLC6A11	G	SNP X LT trauma	0.5419	2.43 E-04
3	rs9873087	SLC9A9	G	SNP X LT trauma	-0.3987	6.22 E-04
5	rs2652511	SLC6A3	A	SNP X LT trauma	0.3853	3.8 E-04
5	rs2550946	SLC6A3	A	SNP X LT trauma	0.3722	5.51 E-04
6	rs10947564	FKBP5	G	SNP X LT trauma	-0.459	7.95 E-04
7	rs1554606	IL6	A	SNP X LT trauma	0.3708	6.87 E-04
9	rs2283123	DBH	A	SNP X LT trauma	0.7322	6.91 E-04
11	rs1491851	BDNF	A	SNP X LT trauma	-0.3721	2.18 E-04
11	rs2140887	BDNF	A	SNP X LT trauma	-0.349	6.19 E-04
11	rs2212449	NCAM1	A	SNP X LT trauma	-0.3991	3.36 E-04
12	rs3759347	GNB3	A	SNP X LT trauma	0.4388	2.01 E-04
17	rs3744215	GRIN2C	A	SNP X LT trauma	-0.4918	8.91 E-05
17	rs7219247	GRIN2C	A	SNP X LT trauma	-0.4918	8.91 E-05
22	rs4646316	COMT	A	SNP X LT trauma	0.5231	4.32 E-05

Summary of Preliminary Genetics Analyses in the ONG sub-sample

- These are highly preliminary gene association and G x E analyses with data presently available sub-sample (N=551 European ancestry)

- FKBP5 G x E (childhood adversity) finding of Binder & Ressler (2008) was replicated in this (small) sample

- Array-wide significant association ($p < 1.1E-05$, SNP x childhood adversity interaction) with central gene in Sympathetic Nervous System (*ADRB2*)

- Potentially interesting ($p < 1E-04$) G x E in dopamine (*SLCA9, COMT*), Opioid (*OPRM1, PENK*), and Glutamate (*GRIN2C, GRIK1*), other (*BDNF, NCAM1*) systems

ADRB2 rs11168068
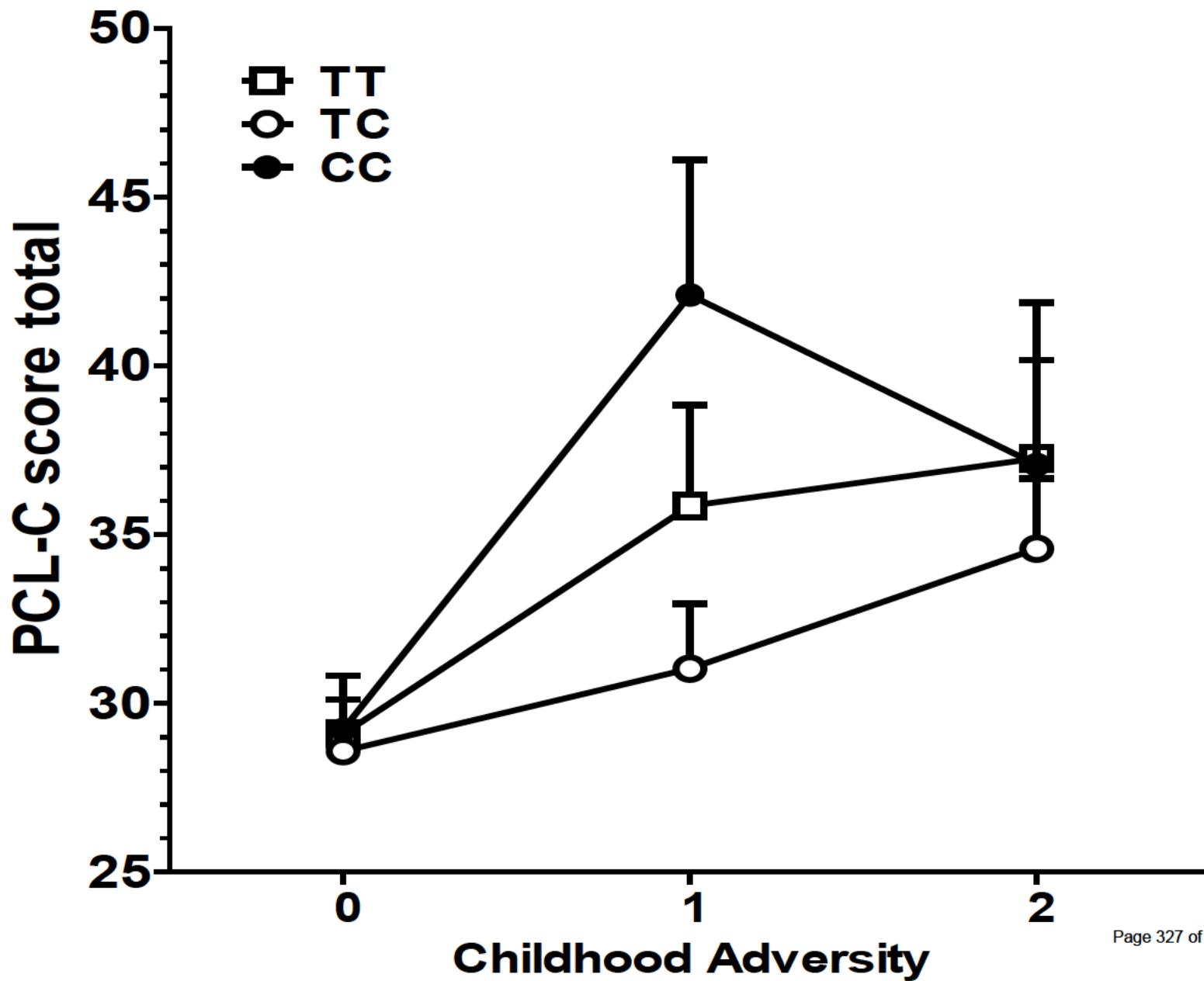
Deployment characteristics, combat, and posttraumatic stress disorder among National Guard Members

Prescott, MR*, Tamburrino M, Liberzon I, Slembarski R, Calabrese J, Galea S
(University of Michigan, Ann Arbor, MI 48109)

The psychological consequences of combat may be modified by deployment characteristics such as proper training and unit support in reserve forces. We assessed the relation between combat, deployment characteristics, and posttraumatic stress disorder (PTSD) among Guard members. We interviewed a representative sample of Ohio National Guard members (N=821, 69% participation rate, 79% male, 32% between the ages of 24-32). Overall 45.5% of Guard members had an overseas deployment and 94.7% of Guard members reported at least one traumatic event. During their most recent deployment, 41.3% experienced high levels of combat, 52.1% felt well prepared, 47.6% felt high unit support, and 42.5% reported being concerned about their home life during deployment. Among those deployed overseas the prevalence of Diagnostic and Statistical Manual of Mental Disorders (IV)-consistent lifetime PTSD was 9.8%. In separate multivariate models, adjusting for demographics, overseas deployment and trauma exposure, high unit support (p-value=0.04) and being concerned about home life (p-value=0.03) both modified the effect of combat on developing PTSD. Specifically, persons experiencing higher unit support or fewer concerns regarding their home life, were less likely to develop PTSD than persons with lower support, or more home life concerns, given similar combat experiences. These data suggest that deployment characteristics of Guard members may jointly affect the psychological impact of deployment. Further work will evaluate the mechanisms, both behavioral and biologic, that may explain how we can modify the effect of combat by improving deployment conditions.

Context of military and civilian traumatic events and with the risk of posttraumatic stress disorder among National Guard soldiers

Prescott MR*, Tamburrino M, Liberzon I, Slembarski R, Goldmann E, Calabrese J, Galea S

While research has shown that the risk of posttraumatic stress disorder (PTSD) is not constant across traumatic event types, little work has examined if the context – military versus civilian – of the traumatic event has an effect on subsequent PTSD. To examine this relation we used the baseline sample of the Kaptur Combat Mental Health initiative, a ten-year longitudinal study of Ohio National Guard. The representative sample (N=2616) is majority male (85.2%) and has deployment experience (64.1%.) Forty eight percent of participants have experienced a traumatic event during their most recent deployment and 91.0% have experienced a traumatic event outside of their most recent deployment. In bivariable associations and according to the Diagnostic and Statistical Manual of Mental Disorders version 4, assaultive traumas in the civilian context (13.3%) as compared to the military context (10.1%, p-value=0.15) had a higher prevalence of PTSD. In contrast, non-assaultive traumas in the civilian context (5.4%) compared to the military context (8.8%, p-value <0.01) had a lower prevalence of PTSD. In multivariable logistic models stratified by trauma type and context, those with low reported social support compared to high support consistently had higher odds of developing PTSD – assaultive military trauma (odds ratio (OR 3.5) 95% confidence interval (CI 1.6-7.8)) and assaultive civilian trauma (OR 5.1, 95% CI 2.2-11.7). These results suggest that while the context and type of the trauma may affect the development of PTSD, certain factors associated with the development of PTSD remained consistent and could be universal avenues for intervention.

Social and military characteristics associated with the co-occurrence of psychopathology among National Guard soldiers

Prescott MR*, Tamburrino M, Liberzon I, Slembarski R, Goldmann E, Calabrese J, Galea S

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Common factors associated with the individual prevalence and co-occurrence of posttraumatic stress disorder (PTSD), depression and generalized anxiety disorder (GAD) may highlight effective pathways to reduce the mental health consequences of war. To examine these relations within military personnel, we used the baseline cohort of the Kaptur Combat Mental Health Initiative – a ten-year longitudinal study of Ohio National Guard soldiers. Comparable to the Ohio National Guard in general, the baseline cohort was majority male (85.2%), white (87.7%), and have been deployed (64.1%.) According to Diagnostic Statistical Manual of Mental Disorders version 4, 79% of the sample has not had either PTSD, depression or GAD within the past within the past year. In the past year, the most common co-occurring conditions were depressive disorder and GAD (4%) while 2.1% of individuals had all three conditions. In multivariable, multinomial logistic models, women as compared to men were more likely to have at least two conditions (odds ratio, OR 2.0, 95% confidence interval CI 1.41-2.86) as compared to no psychopathologies within the past year. Additionally, low reported levels of social support (OR 6.5, 95% CI 4.2-10.1) and high levels of lifetime trauma (OR 7.7, 95% CI 4.5-13.3) were associated with the co-occurrence of at least two as compared to no mental health conditions. These findings suggest that while National Guard soldiers are resilient as a whole, there are common factors associated the co-occurrence of mental health conditions. It is possible that focusing on these factors may allow us to more efficiently intervene on multiple psychopathologies.

Pre-, peri-, and post-deployment characteristics and the risk of posttraumatic stress disorder among Ohio National Guard soldiers

*Goldmann E, Tamburrino M, Liberzon I, Slembarski R, Prescott MR, Calabrese J, Galea S

 (University of Michigan, Ann Arbor, MI, 48109)

Factors related to various stages of deployment – such as feeling prepared for deployment, unit support during deployment, and post-deployment support – may be associated with the risk of developing posttraumatic stress disorder (PTSD) from deployment-related traumatic events. We recruited a random sample of 2616 Ohio National Guard soldiers and conducted structured interviews to assess traumatic event exposure and PTSD related to the soldiers' most recent deployment, consistent with DSM-IV criteria. We assessed preparedness prior to deployment, unit support, and post-deployment support; all instruments showed good internal consistency (alpha=0.68, 0.84, 0.68, respectively). Among the 1294 (49.5%) soldiers who had been deployed and experienced at least one traumatic event during their most recent deployment, the prevalence of deployment-related PTSD was 9.6% overall and 8.7% in the past year. In logistic models adjusted for demographic characteristics, paygrade, deployment location, number of deployments, and number of events experienced during the deployment, soldiers reporting higher levels of preparedness, unit support, and post-deployment support had significantly lower odds of past year PTSD than did those reporting lower levels (odds ratio(OR)=0.4, 95% confidence interval (CI):0.3-0.7, OR=0.4, CI:0.2-0.6, and OR=0.1, CI:0.1-0.2, respectively). Results show that factors throughout the lifecourse, including factors before, during, and after deployment may influence the risk of PTSD. This suggests that interventions aimed at mitigating the consequences of war need to consider soldiers' life experiences and specific aspects of deployment.

Symposium: Risk and resilience in the National Guard

Army National Guard forces may have increased risk of psychopathologies after combat trauma as compared than their active duty counterparts due to differences in deployment experiences, training and ongoing civilian stressors. In this symposium we present findings from the baseline sample of the Kaptur Combat Mental Health Initiative cohort, a ten-year longitudinal study of Ohio Army Guard soldiers. For the baseline, we recruited 2616 randomly selected Ohio Army Guard soldiers who were given an hour-long structured telephone survey and a subset (N=500) were randomly selected to then participate in clinical appraisals. The standardized interviews assessed deployment and home-life characteristics as well as the presence of PTSD, depression, generalized anxiety disorder and substance use disorders. The focus of this symposium will be to highlight the underlying mechanisms and modifiable factors associated with psychopathology among Ohio Army Guard soldiers through four presentations:

1. The Kaptur Combat Mental Health Initiative: baseline collection of a ten-year longitudinal study sample

2. Determinants of co-occurring psychopathology among Ohio Army Guard soldiers

3. Context of military and civilian traumatic events and the risk of posttraumatic stress disorder among Ohio Army Guard soldiers

4. Pre-, peri-, and post-deployment characteristics and the risk of posttraumatic stress disorder among Ohio Army Guard soldiers

The Kaptur Combat Mental Health Initiative: baseline collection of a ten-year longitudinal study sample

The Kaptur Combat Mental Health Initiative is a ten-year longitudinal study of Ohio Army Guard soldiers created to examine the long-term impact of war on guard soldiers. Cohort members participated in baseline telephone interviews between November 2008 and December 2009. The baseline sample was comparable to the Ohio Army Guard overall where the majority were male (85.2%), white (87.7%) and an enlisted personnel or cadet (86.2%.) Compared to the clinician administered PTSD scale, the telephone survey assessment for PTSD (PTSD checklist – civilian) was highly specific (range 91%(SE 0.02) to 97%(0.01) with moderate sensitivity (range 24%(0.09) to 63%(0.17)) depending on the type of diagnosis. The telephone survey assessment (Patient Health Questionnaire) of depression also was highly specific (97%(0.01)) and moderately sensitive (21%(0.04)) compared to the clinical appraisal using the SCID. Other psychopathologies assessed on the telephone included generalized anxiety disorder (sensitivity, se 36% (0.08) and specificity, sp 89%(0.01)) and alcohol dependence (se 78%(0.04) and sp 66%(0.02). The Kaptur Combat Mental Health Initiative will improve our understanding of the mechanisms by which war and stressful circumstances impact the mental health trajectories of soldiers.

Determinants of co-occurring psychopathology among National Guard soldiers

Understanding the modifiable factors associated with co-occurring posttraumatic stress disorder (PTSD), depression, and generalized anxiety disorder (GAD) may highlight effective pathways to mitigate the adverse mental health consequences of war. We used baseline data from the Kaptur Combat Mental Health Initiative cohort that was comparable to the Ohio Army Guard in general. Using Diagnostic Statistical Manual of Mental Disorders IV criteria, the prevalence of PTSD, depression and GAD within the past year was 7.2%, 14.0% and 9.3% respectively; 79% of the sample did not have any of the three conditions. In the past year, the most common co-occurring conditions were depressive disorder and GAD (4%). In multivariable, multinomial logistic models, women as compared to men (odds ratio, OR 2.0, 95% confidence interval CI 1.41-2.86) and those with low reported levels of social support (OR 6.5, 95% CI 4.2-10.1) and high levels of lifetime trauma (OR 7.7, 95% CI 4.5-13.3) were more likely to have at least two conditions as compared to no psychopathologies within the past year. These findings suggest that while National Guard soldiers are resilient as a whole, social support and prior trauma experiences are associated with the co-occurrence of mental health conditions. Focusing on these factors may point to avenues of intervention with this high-risk population.

Context of military and civilian traumatic events and the risk of posttraumatic stress disorder among National Guard soldiers

There is limited data on how comparable traumatic events, experienced in different contexts, may be associated with heterogeneity in risk of posttraumatic stress disorder (PTSD). We examined the differences in the risk of PTSD following traumatic events experienced in civilian vs. in military contexts. Within this representative sample (N=2616), 48% had experienced a trauma during their most recent deployment, 91.0% had trauma outside of their most recent deployment and 9.5% had had PTSD using the Diagnostic and Statistical Manual of Mental Disorders IV. Among those who had experienced a non-assaultive trauma, the prevalence of PTSD was higher among those who had experienced the trauma in the military as compared to the civilian context (8.8% vs. 5.4%, p-value <0.01). In multivariable logistic models stratified by context and limited to those who had experienced a non-assaultive trauma, women were more likely than men to have PTSD in a civilian context (odds ratio, OR 2.7, 95% confidence interval, CI 1.6-4.7) but not in the military context (OR 1.9, 95 CI 0.7-5.1). Similarly, prior traumatic event experiences were associated with greater risk of PTSD in the civilian context (OR 2.8, 95% CI 2.8-11.1) but not in the military context (OR 2.5, 95% CI 0.7-9.0). These results suggest that traumatic events experienced in different contexts may be associated with different risk of PTSD. Future work may fruitfully explore the underlying mechanisms for the role context plays in shaping risk of PTSD after specific traumatic events.

Pre-, peri-, and post-deployment characteristics and the risk of posttraumatic stress disorder among National Guard soldiers

Factors related to various stages of deployment – such as feeling prepared for deployment, unit support during deployment, and post-deployment support – may be associated with the risk of developing posttraumatic stress disorder (PTSD) from deployment-related traumatic events. To examine these factors we assessed preparedness prior to deployment, unit support, and post-deployment support; all instruments showed good internal consistency (alpha=0.68, 0.84, 0.68, respectively). Among the 1294 (49.5%) soldiers who had been deployed and experienced at least one traumatic event during their most recent deployment, the prevalence of deployment-related PTSD was 9.6% overall and 8.7% in the past year. In logistic models adjusted for demographic characteristics, paygrade, deployment location, number of deployments, and number of events experienced during the deployment, soldiers reporting higher levels of preparedness, unit support, and post-deployment support had significantly lower odds of past year PTSD than did those reporting lower levels (odds ratio(OR)=0.4, 95% confidence interval (CI):0.3-0.7, OR=0.4, CI:0.2-0.6, and OR=0.1, CI:0.1-0.2, respectively). Results show that factors throughout the lifecourse, including factors before, during, and after deployment may influence the risk of PTSD due to traumatic events among soldiers. This suggests that interventions aimed at mitigating the consequences of war need to consider soldiers' life experiences together with specific aspects of deployment.

FOR SUBMISSION AS A Scientific and Clinical Report:

Psychiatric Comorbidity in the Baseline Sample of 2,616 Soldiers in the Ohio Army National Guard Study of Combat Mental Health

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Abstract Current Word count - 250

Objective - Study psychiatric comorbidity and suicidal ideation in an ongoing study of soldiers in the Ohio Army National Guard(OANG). Method - Of 12,225 soldiers invited, 63% agreed to participate. After collecting military information, we administered the social support module of the Deployment Risk and Resilience Inventory, Life Events Checklist, PTSD Checklist, Patient Health Questionnaire-9, the Generalized Anxiety Disorder(GAD)-7, and the Mini International Neuropsychiatric Interview (alcohol abuse (AA) and dependence (AD). Results – Within this random representative sample, 64% had at least one past deployment. The prevalence of PTSD within the past year were 6.88%, depression 13.95%, GAD 2.03%, AA 9.63%, AD 7.00%, and none of the above 63.07%. In soldiers with PTSD, GAD was 20 times more likely to have occurred within the past year compared to those without (OR 20.36; 95% CI 11.39-36.38), depression 7 times (OR 7.39; 95% CI 5.4–10.11), AD 3 times (OR 3.02 95% CI 1.99–4.58), and very highly increased risk for having at all 3 conditions (OR 60.86, 95% CI 17.33–213.78); 67% had previously sought help through a professional or a self help group. In soldiers with current PTSD accompanied by at least 2 comorbidities, suicidal ideation (which was present in 62% overall) was 7 times more likely to occur (OR 7.46; 95% CI 3.05-18-26). Conclusions - These findings suggest that soldiers with PTSD frequently have a co-occurring mental health condition and a history of suicidal ideation, which highlights the complexity of this patient population and the magnitude of associated human suffering.

Conflicts of Interest: none

Kimberly M. Wilson, University of Toledo
NASW Ohio Chapter Annual Conference
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Ethics in trauma research: participant reactions to trauma questions in the Ohio National Guard (ONG)

Abstract

There may be concern about iatrogenic harm to participants in studies concerned with history of traumatic event experiences. Although several studies have shown that participants in such research generally appreciate their research engagement and are not harmed by it, this has not been considered in military populations. In-person interviews of ONG members were conducted in the Combat Mental Health Initiative. Axis-I DSM-IV psychopathology was assessed, including PTSD and detailed trauma history. Of 500 participants, 17.2% (n=86) reported being upset by the survey questions at some point during the survey and 7.0% (n=6) of those reported still being upset at the end. Factors associated with increasing the likelihood of participant upset were: history of childhood abuse/neglect (p<.0001); suicidal ideation (34%, p=.001); female gendered participant (37.3%, p<.0001); male-gendered interviewer (24.4%, p=.0002); MDD (31.8%, p<.0001), GAD (37.5%, p=.013), BPD (50.0%, p=.0023), alcohol use disorder (21.2%, p=.0274), drug use disorder (28.6%, p=.0045), and PTSD (61.3%, p<.0001). Proportion of participants who reported discomfort with the study questions was in range of, although a bit higher, than that reported in civilian populations. Understanding the determinants of discomfort

in assessments of this population has important implications for work that, over the next few

years, aims to study mental health among returning soldiers.

Title: Baseline Results and Validation Methods of a 10 year Longitudinal Study of the Ohio Army National Guard.

Educational Objectives
1. Recognize the importance of screening for alcohol use disorders in individuals who have served in the military.
2. Compare lifetime prevalences of depressive disorders and PTSD in the Ohio Army National Guard (OHARNG) to prevalences in the general population.
3. Understand the reliability and validity findings of the methodology being used in the baseline year of this longitudinal study of OHARNG members.

Abstract

Objective
To explore lifetime prevalence of mental disorders and report reliability and validity findings from the baseline year in an ongoing study of the Ohio Army National Guard (OHARNG).

Method
2616 randomly selected OHARNG soldiers received hour-long structured telephone surveys including PTSD Checklist (PCL-C) and Patient Health Questionnaire – 9 (PHQ-9); a subset (N=500) was randomly selected to participate in 2 hour clinical reappraisals, using the Clinician-Administered PTSD Scale (CAPS) and SCID. Interviews occurred between Nov. 2008 and Dec. 2009, and there was an overall 43% participation rate.

Results
The baseline sample was comparable to the OHARNG overall where the majority were male (85%), white (88%) and enlisted personnel or cadets (87%). Most commonly reported lifetime conditions for the telephone sample were: alcohol abuse 24%, alcohol dependence 23.5%, "any depressive disorder" 21.4%, and PTSD 9.6%. Compared to the CAPS, the telephone survey assessment for PTSD was highly specific (92% (SE 0.01)) with moderate sensitivity (54% (SE 0.09)). The telephone assessment (PHQ-9) of "any depressive disorder" also was very specific (83% (SE 0.02)) and moderately sensitive (51% (SE 0.05)) compared to clinical reappraisals using the SCID. Other psychopathologies assessed on the telephone included alcohol abuse (sensitivity 40%, (SE 0.04) and specificity 80% (SE 0.02)) and alcohol dependence (sensitivity, 60% (SE 0.05) and specificity 81% (SE 0.02)).

Conclusions
Validity and reliability statistics for telephone assessments indicated the methods performed well as research instruments. This ten year longitudinal study is expected to advance knowledge of the trajectories of post-deployment psychopathologies among OHARNG members.

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ABSTRACT

Risky driving behavior among Ohio Army National Guard soldiers

Hoggatt KJ, Goldmann E, Prescott M, Calabrese J, Tamburrino MJ, Liberzon I, Galea S

Nearly half all forces engaged in the recent wars in Iraq and Afghanistan were reserve forces and there is an increasing reliance on national guard soldiers in combat. Although there is emerging evidence of long term behavioral disorders after deployment among these forces, we know little about health risk behavior, such as risky driving,among national guard soldiers. We recruited2616 Ohio Army National Guard soldiers, 1294 of whomhad been deployed and experienced at least one traumatic event during the most recent deployment. Overall, 12% reported drinking and driving within the past 30 days, 26% reported passing cars on the right often within the past year, and 25% reported ignoring speed limits during the night or early morning often within the past year. Mental health (PTSD, generalized anxiety disorder, major depression) and alcohol abuse or dependence wereassociated with increased risky driving. In men, alcohol abuse or dependence predicted risky driving (drinking and driving: odds ratio (OR) and 95% confidence interval (CI) =7.5 (5.0, 11.4); passing on the right: 2.5 (2.0, 3.1); ignoringspeed limits: 2.2 (1.8, 2.7)even after controlling for mental health history, deployment, and demographic characteristics. Results for women were similar.Deployment was associated with risky driving for men (OR (95% CI): 1.6 (1.1, 2.3) for drinking and driving, 1.6 (1.2, 2.1) for passing on the right, and 1.2 (0.9, 1.6) for ignoring speed limits). Among recently deployed men, risky driving increased with the number of traumatic events experienced.Post-deployment support of reserve forces, particularly those who have seen combat, should include attention to potential for health risk behavior such as risky driving.

Area topic: Psychiatric epidemiology

Title of Paper: Mental health disorders increase the risk of during and post-deployment alcohol abuse among Ohio Army National Guards

Conference: International Society for Traumatic Stress Studies 27th Annual Meeting

Presentation Type: Oral/Poster Presentation

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Background: Alcohol use disorders are common in military personnel; however, it is not clear if mental health conditions increase the risk of during and post-deployment alcohol abuse among this population.

Methods: Ohio National Guards were randomly selected to complete computer-assisted telephone interviews between June 2008 and February 2009. The primary outcome was reporting alcohol abuse meeting DSM-IV criteria first occurring during or post-deployment. Primary exposures of interest included during-/post-deployment major depressive disorder (MDD) and posttraumatic stress disorder (PTSD). Predictive logistic regression was used to determine the independent correlates of during-/post-deployment alcohol abuse.

Results: Of 963 deployed participants, 113 (12%) screened positive for during-/post-deployment alcohol abuse, of whom 35 (34%) and 23 (33%) also reported during-/post-deployment MDD and PTSD, respectively. In a multivariate model MDD (adjusted odds ratio [AOR] = 3.89, 95%CI: 2.12-7.15, $p<0.001$) and PTSD (AOR=2.73, 95%CI: 1.37–5.42, $p=0.004$) were associated with alcohol abuse. The conditional probability of during-/post-deployment alcohol abuse was 7%, 16%, 22%, and 43% among those with no MDD/PTSD, PTSD only, MDD only, and both PTSD and MDD, respectively.

Conclusions: We observed a high prevalence of during-/post-deployment alcohol abuse among Ohio National Guards. Concurrent mental health conditions were highly predictive of developing alcohol abuse, and thus may constitute an etiologic pathway through which deployment-related exposures increase the risk of alcohol problems.

Count: 211 words, 1397 characters (max. 1400 characters)

Panel Presentation: Identifying predictors of trauma response: State of the art of current prospective studies of PTSD

Psychiatric Comorbidity in the Baseline Sample of 2,616 Soldiers in the Ohio Army National Guard Study of Combat Mental Health

DESCRIPTION

Section 1: Primary Purpose or focus of the panel.

Study psychiatric comorbidity in the baseline sample of an ongoing long-term study of soldiers in the Ohio Army National Guard (OANG).

Section 2: Experimental design or Methods used.

Of 12,225 soldiers invited, 63% agreed to participate. After collecting military information, we administered the social support module of the Deployment Risk and Resilience Inventory, Life Events Checklist, PTSD Checklist, Patient Health Questionnaire-9, the Generalized Anxiety Disorder (GAD)-7, and the Mini International Neuropsychiatric Interview section on alcohol abuse (AA) and dependence (AD). Assessment tools were tested in clinical re-appraisal.

Section 3: Summary of results.

Within this random representative sample, 64% had at least one past deployment and the prevalence of PTSD within the past year were 6.88%, depression 13.95%, GAD 2.03%, AA 9.63%, AD 7.00%, and none of the above 63.07%. In soldiers with PTSD, GAD was 20 times more likely to have occurred within the past year compared to those without (OR 20.36; 95% CI 11.39-36.38), depression 7 times (OR 7.39; 95% CI 5.4–10.11) and AD 3 times (OR 3.02 95% CI 1.99–4.58). Soldiers with PTSD were also at high risk for having had all 3 conditions (OR 60.86, 95% CI 17.33–213.78) and 67% had previously sought help through a professional or a self help group.

Section 4: Conclusion statement.

These findings suggest that while the OANG are facing as much combat as the regular army, in cross-study comparisons, it appears that they are rather resilient to mental health conditions common after combat exposure. For those who do have PTSD, they almost always have a co-occurring mental health condition, which highlights the complexity of this population and the magnitude of their unmet clinical need. Participants are administered the survey annually in order to study the longitudinal trajectory of psychopathology.

UNIQUE DATA

In a representative sample of National Guard soldiers we found that soldiers with PTSD were more likely than soldiers without PTSD to report suicidal ideation and that among those with PTSD, comorbidity with more than one disorder was associated with a substantially higher risk for suicidal ideation. The association between PTSD and suicidal ideation in the National Guard adds to the growing evidence of this association in military populations. The data is unique as no other projects have focused on the National Guard or non-treatment seekers outside of the veteran's administration.

Title: Baseline Results and Validation Methods of a 10 year Longitudinal Study of the Ohio Army National Guard.

Primary Topic
Epidemiology

Secondary Topic
PTSD

Educational Objective
At the conclusion of this session, the participant should be able to recognize the importance of screening for alcohol use disorders, depressive disorders and PTSD in individuals who have served in the military.

Abstract

Objective
To explore lifetime prevalence of mental disorders and report reliability and validity findings from the baseline year in an ongoing study of the Ohio Army National Guard (OHARNG).

Method
2616 randomly selected OHARNG soldiers received an hour-long structured telephone survey including the PTSD Checklist (PCL-C) and Patient Health Questionnaire – 9 (PHQ-9); a subset (N=500) was randomly selected to participate in 2 hour clinical reappraisals, using the Clinician-Administered PTSD Scale (CAPS) and SCID. Interviews occurred between Nov. 2008 and Dec. 2009, and there was an overall 43% participation rate.

Results
The baseline sample was comparable to the OHARNG overall where the majority were male (85%), white (88%) and enlisted personnel or cadets (87%). The most commonly reported lifetime conditions for the telephone sample were: alcohol abuse 24%, alcohol dependence 23.5%, "any depressive disorder" 21.4%, and PTSD 9.6%. Compared to the CAPS, the telephone survey assessment for PTSD was highly specific (92% (SE 0.01)) with moderate sensitivity (54% (SE 0.09)). The telephone assessment (PHQ-9) of "any depressive disorder" also was very specific (83% (SE 0.02)) and moderately sensitive (51% (SE 0.05)) compared to the clinical reappraisal using the SCID. Other psychopathologies assessed on the telephone included alcohol abuse (sensitivity, SE 40% (0.04) and specificity, SE 80% (0.02)) and alcohol dependence (sensitivity, SE 60% (0.05) and specificity, SE 81% (0.02)).

Conclusions
Validity and reliability statistics for the telephone assessments indicated the methods performed well as research instruments. This ten year longitudinal study is expected to advance knowledge of the trajectories of post-deployment psychopathologies among OHARNG members.

Co-Author(s) Information
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Hoge CW, Castro CA, Messer SC, McGurk D, Cotting PI, Koffman RL: Combat duty in Iraq and Afghanistan, mental health problems and barriers to care. N Engl J Med 2004; 351:13-22.

The Ohio Army National Guard Mental Health Initiative: Prevalence of DSM-IV Disorders

Objective:

To explore the lifetime and current prevalence of DSM-IV Axis I disorders among a subsample of the Ohio Army National Guard (OHARNG).

Method:

1052 (40.2%) of 2616 OHARNG soldiers who completed a telephone survey were randomly invited to participate in the in-depth clinical cohort assessments using the Clinician-Administered PTSD Scale and the Structured Clinical Interview for DSM-IV-TR. Of those invited, 11.9% (n=125) declined. Of the remaining 952, 21 (2.3%) did not attend their scheduled interview, and the goal of 500 was met before the remaining 406 (43.7%) were contacted. Interviews occurred in neutral settings such as private library rooms, between November 2008 and December 2009.

Results:

The prevalence of at least one DSM-IV disorder was 66.4% (332); substance use disorders were the most prevalent (52.2%), followed by mood disorders (30.0%) and anxiety disorders (22.0%). The prevalence of at least one current disorder was 25.0% (n=83); alcohol abuse (28.2%), MDD (22.4%) and alcohol dependence (20.4%) were the most common. Deployed soldiers had a higher lifetime prevalence of alcohol use disorders (53.0% vs. 39.5%, p=0.0049) and PTSD (6.8% vs. 2.5%, p=0.0447) compared to those never deployed. Women were more likely than men to have any mood disorder history (43.3% vs. 28.2%, p=0.0163).

Conclusions:

Alcohol abuse and MDD were the two most common lifetime disorders, similar to the general population. However, the prevalence of alcohol abuse in the OHARNG was twice the rate in the general population. The fourth most common disorder in this study was drug use, compared to specific or social phobia in the general population. Women were more likely to have mood disorder history, as expected from other general and military study populations. However, we did not find the expected lower prevalence of substance abuse in women. Clinicians should ask patients about military service, and carefully screen for substance abuse.

Conference: Society for Epidemiologic Research 2012 Annual Meeting

Abstract Title: Posttraumatic stress disorder and HIV risk behavior among Army National Guard Soldiers: The mediating role of depression

Name of Presenter: Brandon DL Marshall

Authors: Brandon DL Marshall, Marta R Prescott, Israel Liberzon, Marijo B Tamburrino, Joseph R Calabrese, and Sandro Galea

Topic Areas: Psychiatric; Behavioral

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Abstract:

Posttraumatic stress disorder and HIV risk behavior among Army National Guard Soldiers: The mediating role of depression. *BDL Marshall, MR Prescott, I Liberzon, MB Tamburrino, JR Calabrese, and S Galea (Columbia University, New York, NY, 10032)

The objective of this study was to examine the relationship between posttraumatic stress disorder (PTSD) and engagement in HIV risk behavior among a sample of Ohio Army National Guard (OHARNG) soldiers, and to determine whether new onset depression after exposure to a traumatic event mediated this association.We analyzed data collected from a representative sample of OHARNG enlisted between June 2008 and February 2009. Participants completed interviews assessing engagement in activities defined by the Behavioral Risk Factor Surveillance System (BRFSS) as HIV risk factors (e.g., intravenous drug use, unprotected anal intercourse, sex work, or treatment for an STD) and were screened for PTSD and depression based on DSM-IV criteria. Logistic regression was used to estimate the direct and indirect effects of PTSD on HIV risk behavior.Of 2,282 participants, 147 (6.4%) reported at least one HIV risk behavior. PTSD was independently

associated with HIV risk behavior (adjusted odds ratio [AOR] = 2.1, 95%CI: 1.1 – 3.9), as was depression (AOR = 2.2, 95%CI: 1.5 – 3.2). After depression was included as a mediator, the association between PTSD and HIV risk decreased in magnitude (AOR = 1.8, 95%CI: 0.9 – 3.4), suggesting partial mediation (Sobel test $p < 0.01$). Soldiers with PTSD may be at greater risk of HIV infection due to increased engagement in HIV risk behavior. New onset depression following exposure to trauma appears to mediate this relationship. Integrated interventions to address mental health problems and reduce engagement in HIV risk behavior are in need of development and evaluation.

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Abstract:

Background: Persons with posttraumatic stress disorder (PTSD) and other mental health conditions are more likely to practice HIV risk behaviors, and military personnel represent one population at increased risk for trauma exposure and subsequent development of PTSD. We examined the relationship between PTSD and engagement in HIV risk behavior among a sample of Ohio ARNG soldiers, and determined whether new onset depression after exposure to a traumatic event mediated this association.

Methods: We analyzed data collected from a representative sample of OHARNG enlisted between June 2008 and February 2009. Participants completed interviews assessing engagement in activities defined by the Behavioral Risk Factor Surveillance System (BRFSS) as HIV risk factors (e.g., intravenous drug use, unprotected anal intercourse, sex work, or treatment for an STD) and were screened for PTSD and depression based on DSM-IV

criteria. Logistic regression was used to estimate the direct and indirect effects of PTSD on HIV risk behavior.

Results: Of 2,282 participants, the majority were male (86.3%), Caucasian (88.3%), and less than 35 years of age (64.8%). In total, 147 (6.4%) reported at least one HIV risk behavior. PTSD was independently associated with HIV risk behavior (adjusted odds ratio [AOR] = 2.1, 95%CI: 1.1 – 3.9), as was depression (AOR = 2.2, 95%CI: 1.5 – 3.2). After depression was included as a mediator, the association between PTSD and HIV risk decreased in magnitude (AOR = 1.8, 95%CI: 0.9 – 3.4), suggesting partial mediation (Sobel test $p < 0.01$).

Conclusions: Soldiers with PTSD may be at greater risk of HIV infection due to increased engagement in HIV risk behavior. New onset depression following exposure to trauma appears to mediate this relationship. Integrated interventions to address mental health problems and reduce engagement in HIV risk behavior are in need of development and evaluation.

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Participant Reactions to Trauma Questions in the Ohio Army National Guard (OHARNG)

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Several studies have shown that participants in trauma research generally appreciate their research engagement and do not suffer inadvertent adverse effects. There is limited research of this type in military populations, where members can be exposed to both combat trauma and traumas that occur in their civilian lives. This study evaluates the effects of asking Ohio Army National Guard (OHARNG) members to recall details of their trauma exposure, and identifies factors that may put participants at risk of becoming upset by such assessments. In-person interviews of OHARNG members were conducted by trained clinicians to obtain detailed trauma history and to assess Axis-I DSM-IV psychopathology, including PTSD. Of 500 participants, 17.2% (n=86) reported being upset during the survey and 7.0% (n=6) of those reported still being upset at the end. Factors associated with increasing the likelihood of participant upset were: history of childhood abuse/neglect (p<.0001); suicidal ideation (34%, p=.001); female gendered participant (37.3%, p<.0001); male-gendered interviewer (24.4%, p=.0002); MDD (31.8%, p<.0001), GAD (37.5%, p=.013), BPD (50.0%, p=.0023), alcohol use disorder (21.2%, p=.0274), drug use disorder (28.6%, p=.0045), and PTSD (61.3%, p<.0001). Understanding the determinants of assessment discomfort of this population has important implications for studying mental health among returning soldiers.

Child abuse and psychopathology developed during deployment in a sample of National Guard soldiers

Research suggests childhood trauma may affect the risk of developing psychopathology after trauma, however it is not well understood how childhood experiences may affect the risk of developing psychopathology in soldiers who are deployed. We recruited a sample of 2616 Ohio National Guard soldiers and conducted structured interviews to assess traumatic event exposure, deployment history and psychopathology(posttraumatic stress disorder (PTSD), depression and alcohol abuse) first occurring in relation to the soldiers' most recent deployment, consistent with DSM-IV criteria. Among the 1143 soldiers with child abuse data who had been deployed, 15.7% had experienced a form of child abuse. The prevalence of psychopathology first developed during or after deployment ranged from 9.3% for depressionto 6.3% for alcohol abuse. In logistic models adjusted for demographic characteristics and deployment location, soldiers reporting at least two forms of child abuse had significantly higher odds of depression developed during deployment(odds ratio(OR)=2.0, 95% confidence interval (CI):1.1,3.7) as compared to those without any form of child abuse. There was not a dose response between forms of child abuse andother psychopathology. Results suggest thatearly childhood exposure to multiple types of abuse may predispose soldiers to develop depressive symptoms but not other forms of psychopathology during deployment. Intervention for soldiers returning from overseas deployment may target this high-risk population to better to mitigate the effects of war.

An Abstract of

Relations Between the Underlying Dimensions of PTSD and Major Depression Using an

Epidemiological Survey of Deployed Ohio National Guard Soldiers

A study was conducted which investigated the relationship between the underlying symptom

dimensions of posttraumatic stress disorder (PTSD) and dimensions of major depressive

disorder. A sample of 1,266 Ohio National Guard soldiers with a history of overseas deployment

participated, administered the PTSD Checklist (assessing PTSD) and Patient Health

Questionnaire-9 (assessing depression). Using confirmatory factor analysis, results demonstrated

that both PTSD's dysphoria and hyperarousal factors were more related to depression's somatic

than non-somatic factor; however, PTSD's dysphoria was more related to somatic depression

than PTSD's hyperarousal factor was. Results have implications for understanding the nature of

PTSD's high comorbidity with depression, given PTSD's substantial dysphoria/distress

component.